16

A SYSTEMS APPROACH TO ORGANISATIONAL CHANGE LEADING TO WORLD CLASS MANUFACTURING

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Submitted to the University of Cape Town in partial fulfillment of the requirements for the degree of Master of Science in Engineering Management.

I, Alan Fred Christopher, submit this thesis for the degree of Master of Science in Engineering Management. I claim that this is my original work and that it has not been submitted in this or in a similar form for a degree at any University.

Signed by candidate

A F CHRISTOPHER

Abstract

The author has reviewed World Class Manufacturing and considered the traditional ways of embarking on world class manufacturing initiatives. The reason for the failure of many of these initiatives has been argued.

From a systems theory of organisations and the theory of levels of existence, a systemic process to becoming a world class manufacturing organisation has been postulated.

This process has been formulated into a Coping Development model. A critique of the model has been included. The critique discusses obstructions to development and draws conclusions regarding the models application.

Acknowledgements

Thanks are extended to the following:

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CONTENTS

LIST OF FIGURES

X

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1.0 INTRODUCTION

The differences between the game of Ice Hockey and a Ballet appear to have nothing to do with manufacturing organisations.

Crosby however, draws an interesting parallel in his book "Quality if free" (1).

Consider first, the game of Ice Hockey:

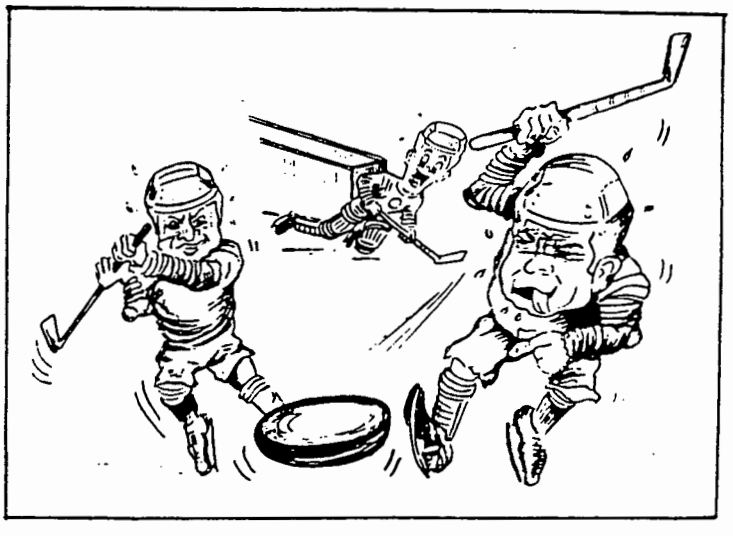


Fig. 1.1: Ice Hockey - An Exciting Game

The game starts when the puck is dropped and the players rush about with energy and enthusiasm, applying their learned skills, experience and natural talent. Each game is an original event but with the same outcome, somebody wins and somebody loses.

At the end of the game, the players are all hot and sweaty and some feel good about the way the game went and some feel bad.

Hockey is no doubt an exciting game, but is it a good management style?

Ballet on the other hand is a preplanned, choreagraphed and conducted event.

Fig. 1.2: Ballet - A Creative Event

All of the actors are playing out their roles, and with the timing of the music and the help of the conductors baton, a creative event unfolds. Each performance however,is original due to the creative innuendos of the artists and the response of the audience.

Reflecting back on the images of the game of Ice Hockey, the similarities to the average manufacturing organisation, solving the same old problems day in and day out become clearer. Surely it would be more satisfying and yet challenging to work in a "Ballet" organisation?

The purpose of this thesis therefore is to explore how organisations can change from a "hockey" to a "ballet" culture and to formulate a model of organisational learning.

1.1 Assumptions and Limitations

1.1.1 Assumptions

The primary assumption of this thesis is that organisational change from "Hockey" style to "Ballet" style is both desirable and possible.

1.1.2 Limitations

A detailed technical study of manufacturing systems has not been included. The focus is rather on the elements of organisational

development.

The discussion is centred on the production aspects of a manufacturing organisation. This is to limit the scope of the dissertation and does not imply that the Sales, Financial and Research and Development functions are less important or should be excluded from a change process. The contrary is believed to be true, a holistic view of an organisation must be considered in any real, changing environment.

The study of an organisation has been limited to the systems viewpoint. Organisational behaviour per se is a social science beyond the scope of this dissertation.

1.2 The Dissertation Structure

The discourse is divided into three sections and attempts to answer the following questions:

How does South African manufacturing become internationally competitive?

How can this improvement process be speeded up?

What could go wrong during the process? - a critique.

Each section will be introduced by discussing a situation and a complication to the situation which leads to the section question.

The questions will be answered inductively by discussing key elements leading to a similar conclusion.

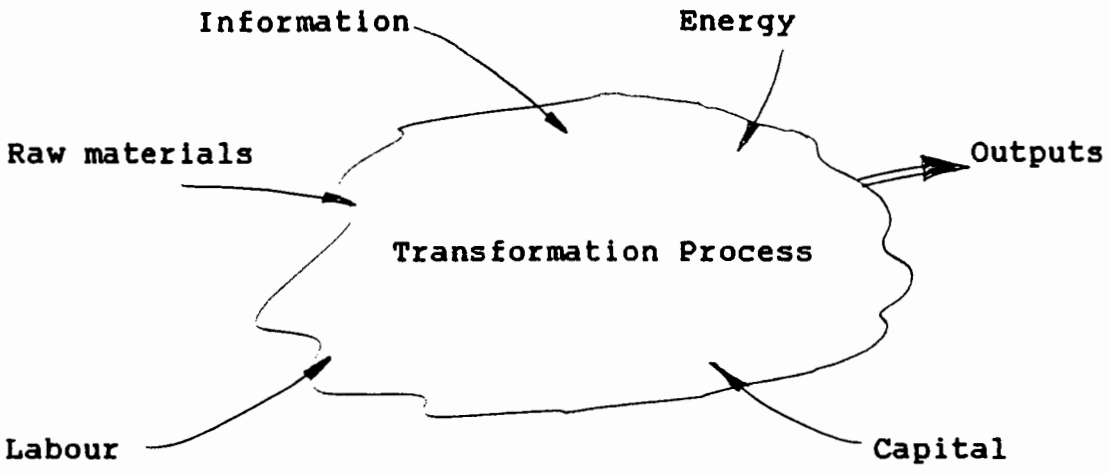
1.3 Question 1 - HOW DOES SOUTH AFRICAN MANUFACTURING BECOME INTERNATIONALLY COMPETITIVE?

It is important to appreciate how South African companies compare to other developed and developing countries.

The National Productivity Institute's 1993 Productivity Focus (2) has been used to illustrate South Africa's productivity status.

1.3.1 The Status of South African Productivity

Productivity may be defined as "The Physical output per unit of capital, unit of labour, unit of energy and unit of raw materials" (2). This is shown graphically in Fig. 1.3.



$$\text{Productivity} = \frac{\text{output}}{\text{sum of inputs}}$$

Fig. 1.3: A Graphical View of Productivity.

There are a number of different measures of productivity. A common macro measure is by comparing the real Gross Domestic Product (GDP) per employed person for different countries. The figures shown have been corrected for inflation and therefore reflect GDP versus time in real terms.

The GDP per worker for South Africa compared to Developed and Developing countries is shown in Figures 1.4 and 1.5 respectively.

GROSS DOMESTIC PRODUCT/WORKER IN 1985
PRICES AND EXCHANGE RATES IN RANDS

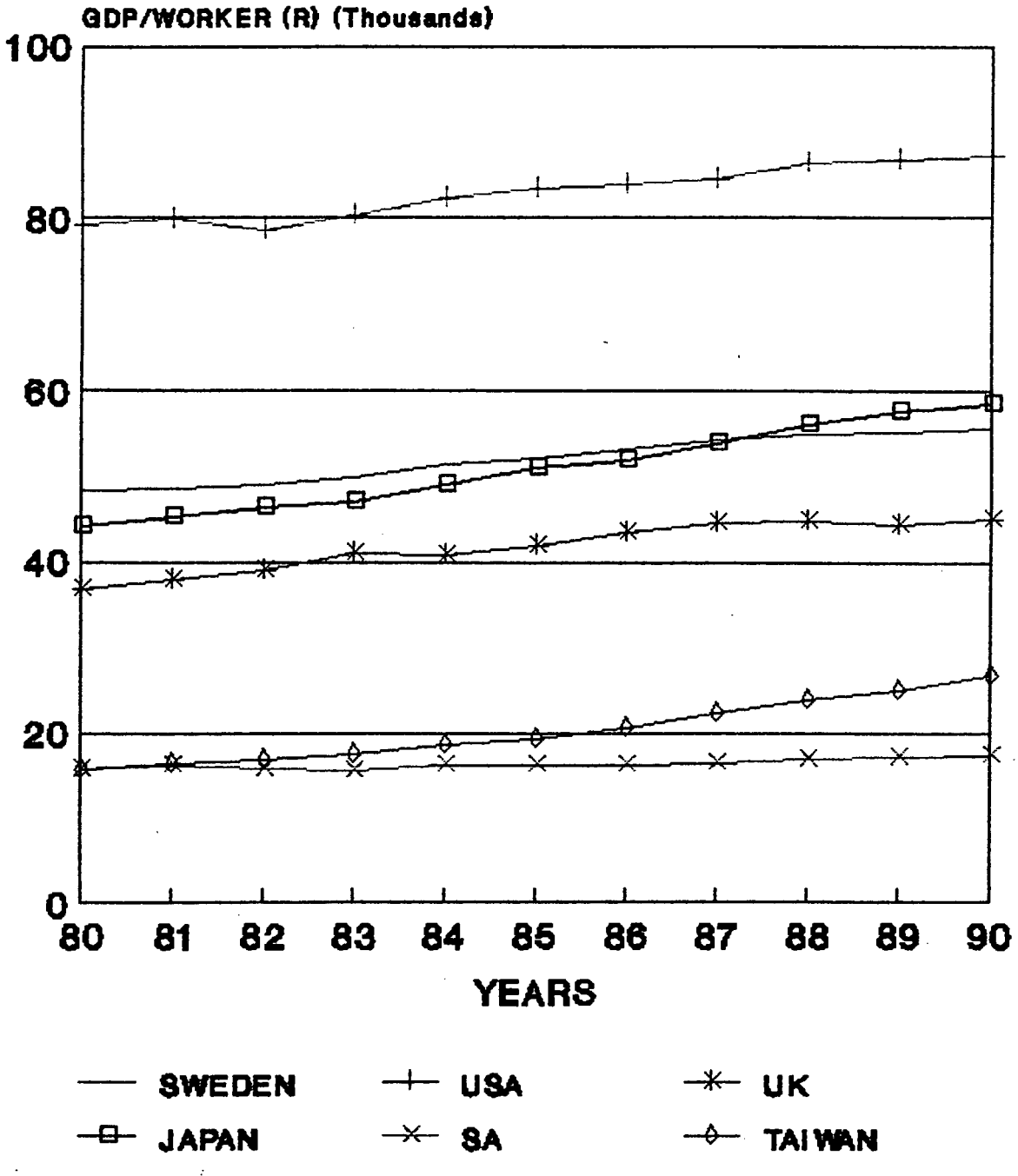


Fig. 1.4
Developed Countries

Source: NPI Productivity Focus 1993.

GROSS DOMESTIC PRODUCT/WORKER IN 1985
PRICES AND EXCHANGE RATES IN RANDS

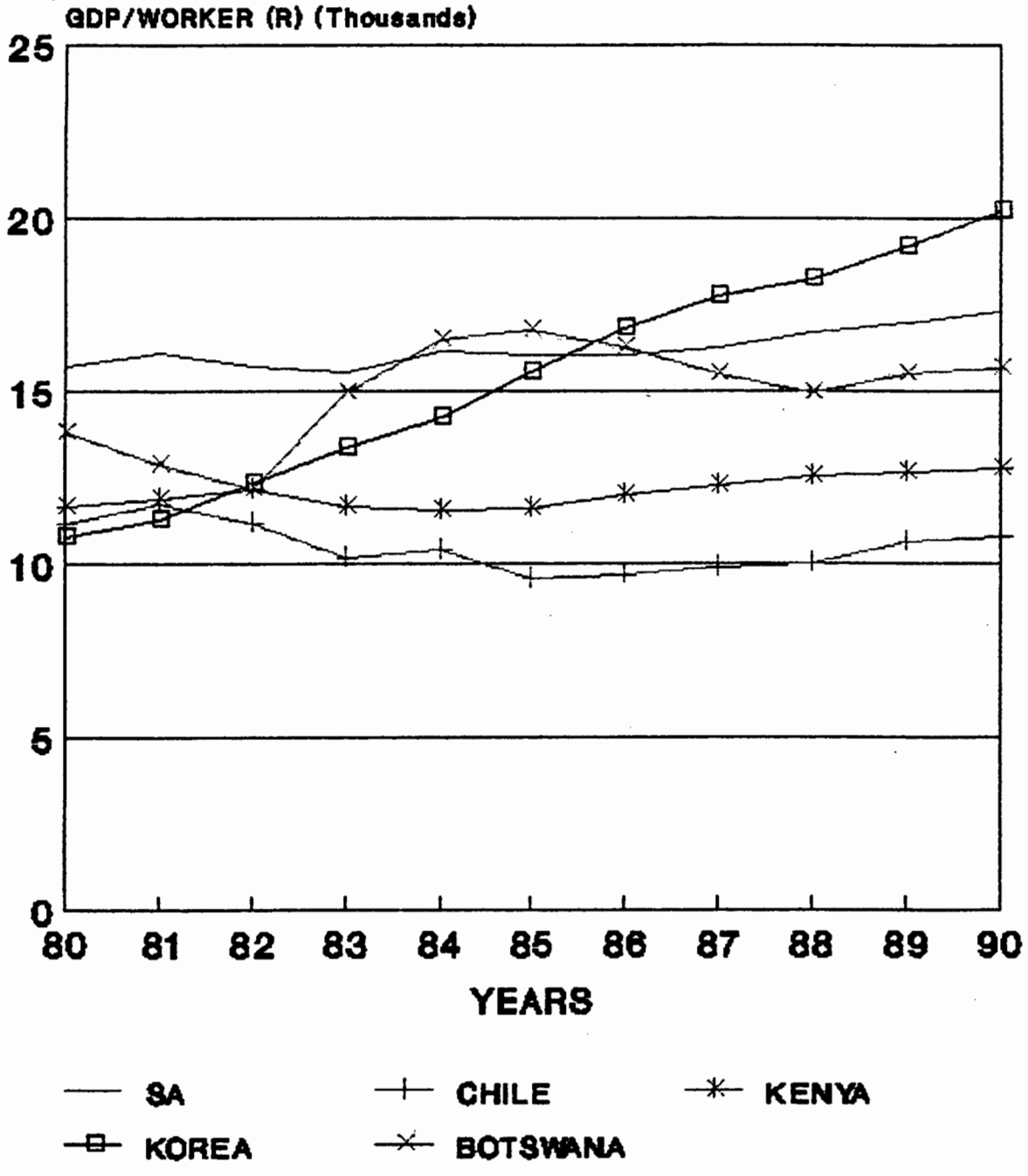


Fig. 1.5
Developing Countries

Source: NPI Productivity Focus 1993.

Fig. 1.4 shows that South African productivity levels are significantly below that of developed countries and comparable with developing countries. Apart from the productivity levels, the productivity growth rate is important as it reflects where South Africa is heading.

Country	Annual Productivity (GDP per worker) Growth rate % (period 1980 - 1990)
Korea	6.5%
Taiwan	5.4%
Japan	2.9%
U K	2.0%
France	1.6%
Sweden	1.4%
Botswana	1.3%
South Africa	**1.0%**
USA	0.9%
Kenya	0.9%
Chile	-0.3%

The 1% annual productivity growth rate is well below many countries, but there is nevertheless an improvement. Of great concern however, is that during the same period that the 1% growth rate occurred, the population grew by 2.6% per annum. In addition, the productivity improvement was achieved not by improved outputs, but by reduced inputs. This scenario is not healthy for the future of South Africa, unemployment will grow and unemployment is a further indication of competitiveness weakness (3).

The 1992 World Competitiveness Report ranked countries according to their 1989 value added per employee in manufacturing (4).

Figures 1.6, 1.7 and 1.6 show the value added per worker for manufacturing (all sectors), textiles and clothing respectively.

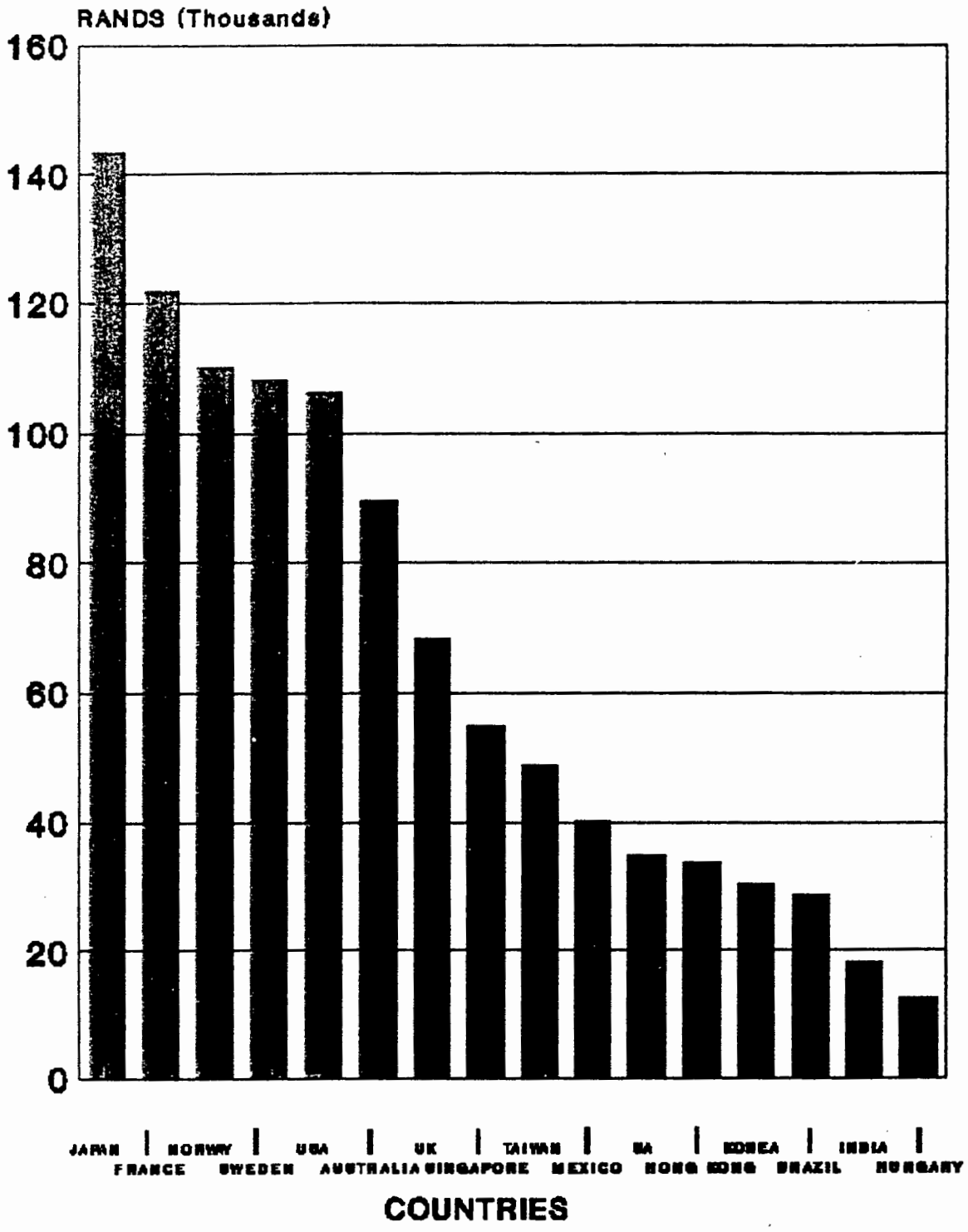


Fig 1.6

The value added per employee (1989).

Source: NPI Productivity Focus 1993.

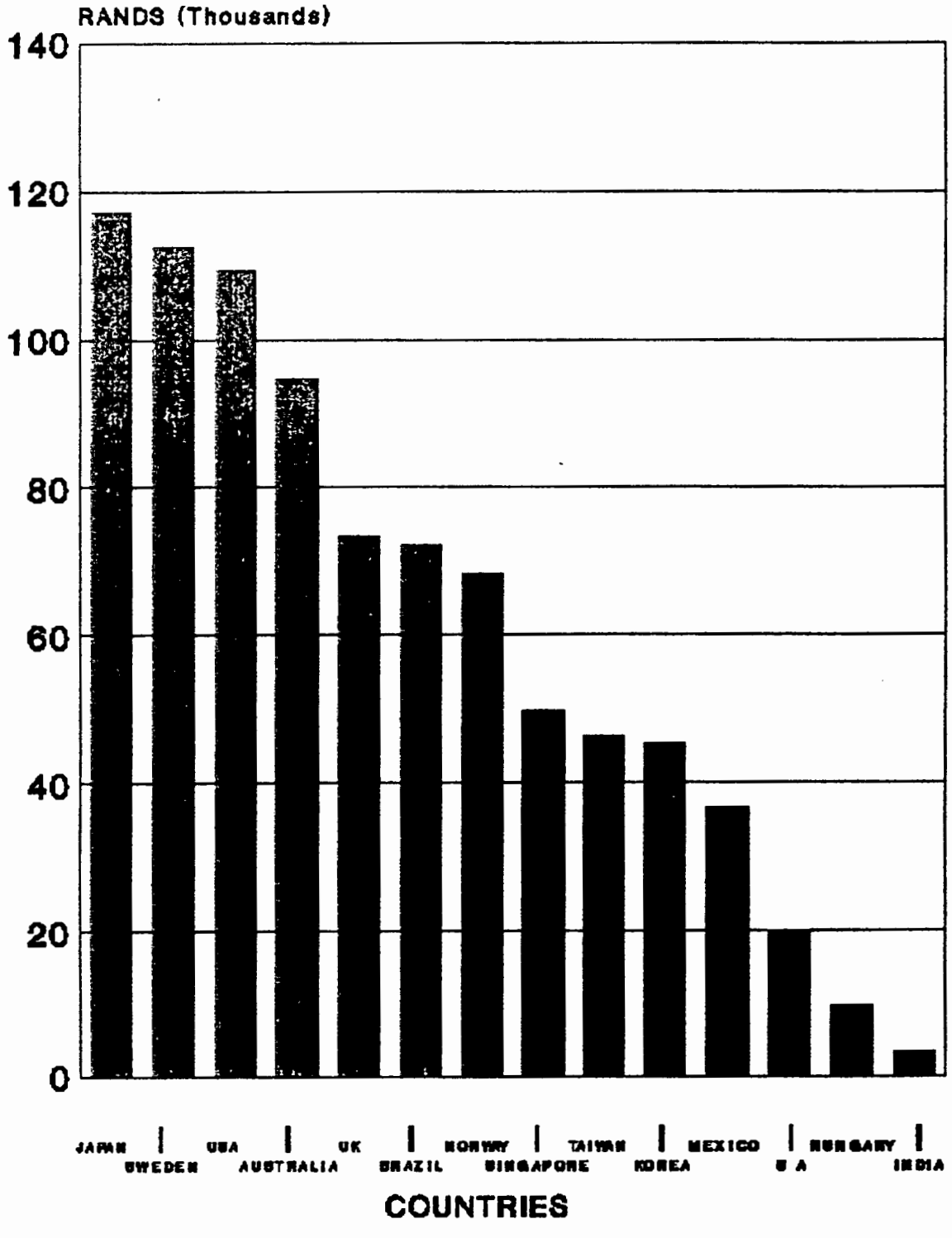


Fig. 1.7

The value added per employee (1989).

Source: NPI Productivity Focus 1993.

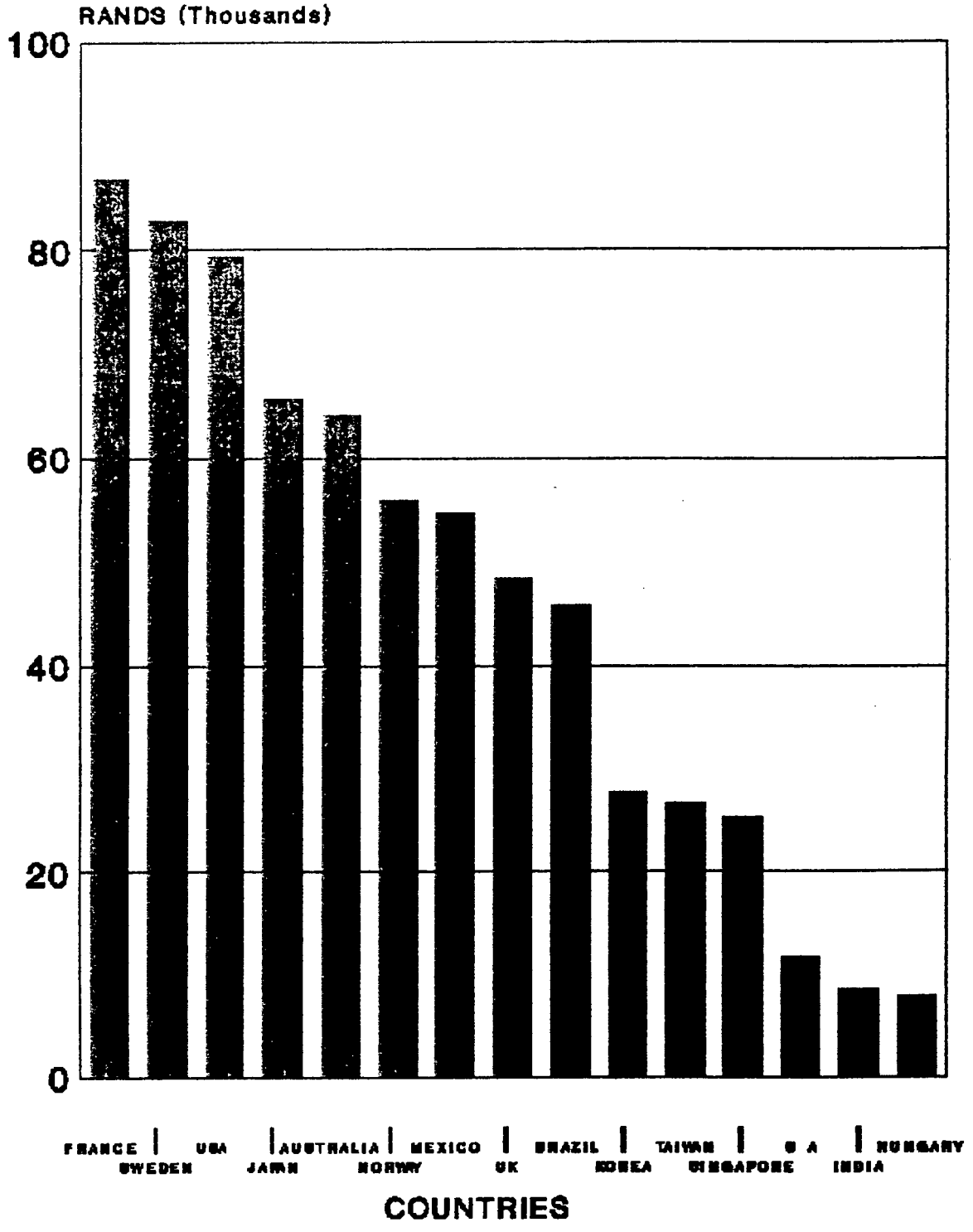


Fig. 1.8

The value added per employee (1989).

Source: NPI Productivity Focus 1993.

From the figures above, the value added per employee is typically five to six times higher in Japan than South Africa.

The consequences of the poor performance of the South African manufacturing sector are shown in the multifactor productivity graphs below.

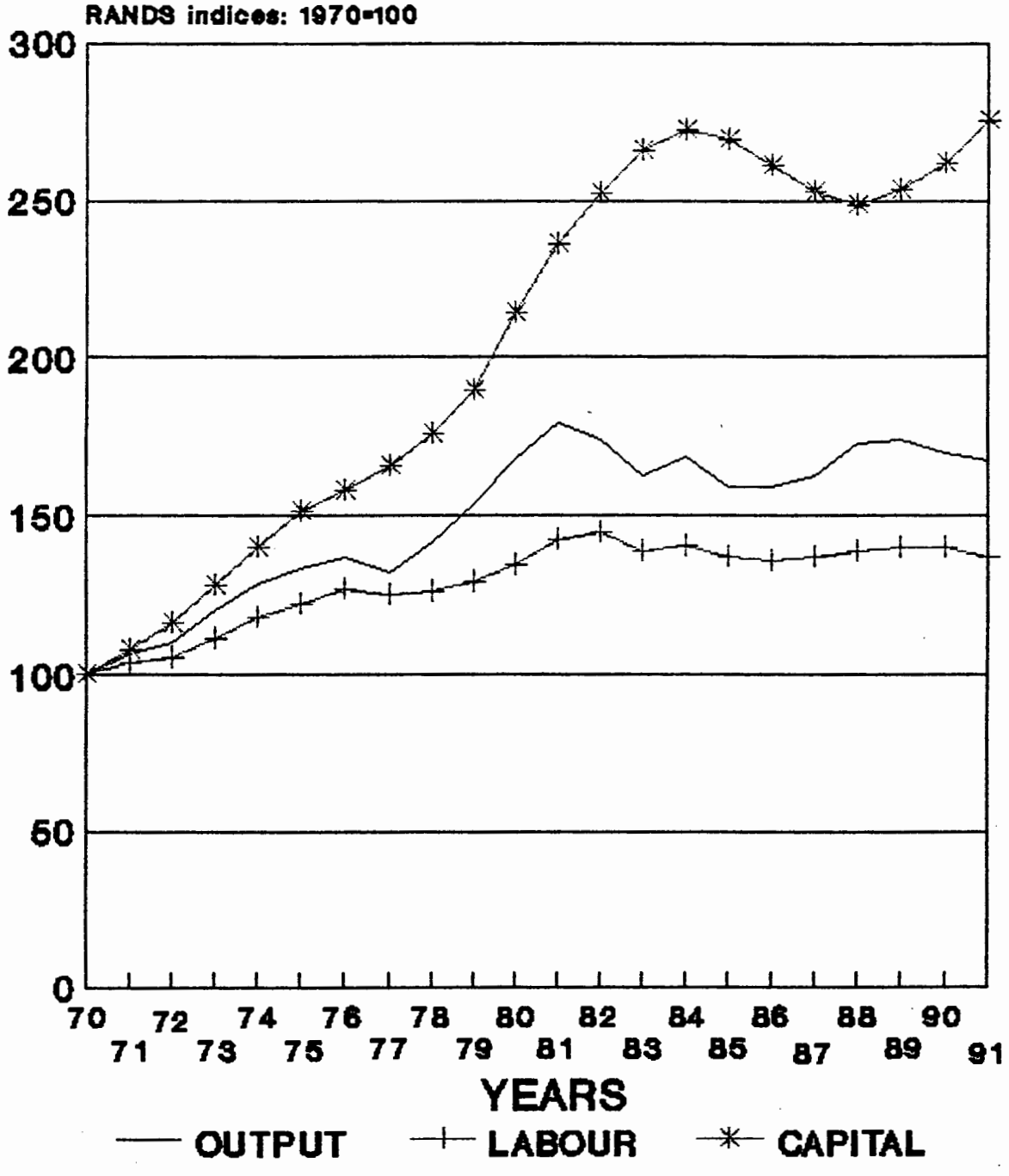


Fig. 1.9 Output and Input trends

Source: NPI Productivity Focus 1993

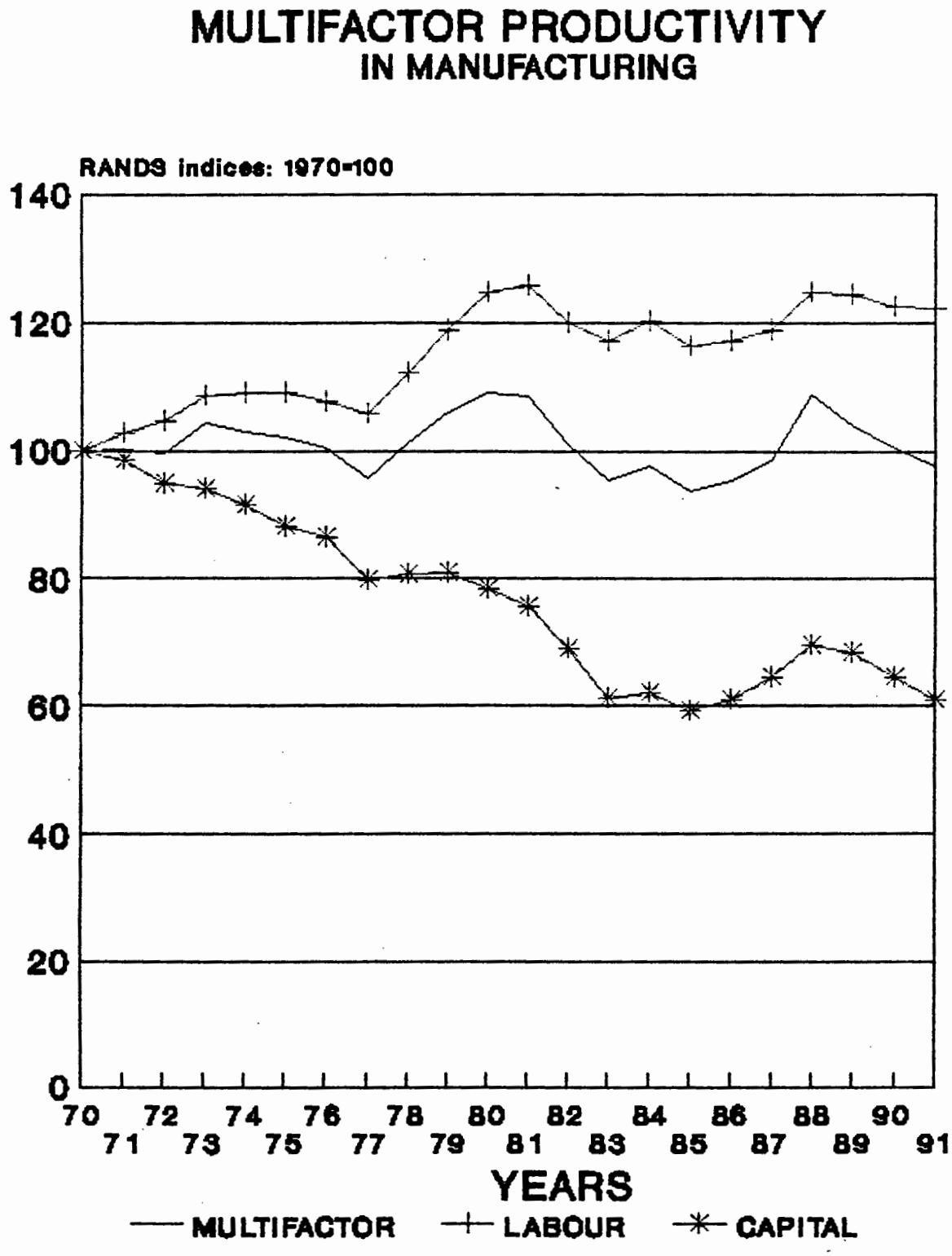


Fig. 1.10 Multifactor Productivity

Source: NPI Productivity Focus 1993

Figure 1.9 shows that labour input has increased at 1.5% per annum for the past twenty years while capital has increased by 5% per annum. In addition, the real output has stayed virtually static over the last ten years.

This combination has resulted in an overall manufacturing multifactor productivity which has shown no real improvement over the last twenty years, as shown in Fig. 1.10.

South Africa's situation regarding productivity may be summarised as:

* On a macro level, GDP per worker is well below developed countries

* The value added per employee in South Africa is typically 5 to 6 times less than Japan

* The manufacturing multifactor productivity in South Africa has not improved over the last 20 years.

From the 1993 World Competitiveness Report, South Africa has slipped from eighth to eleventh place in a fifteen way comparison of emerging industrial nations.

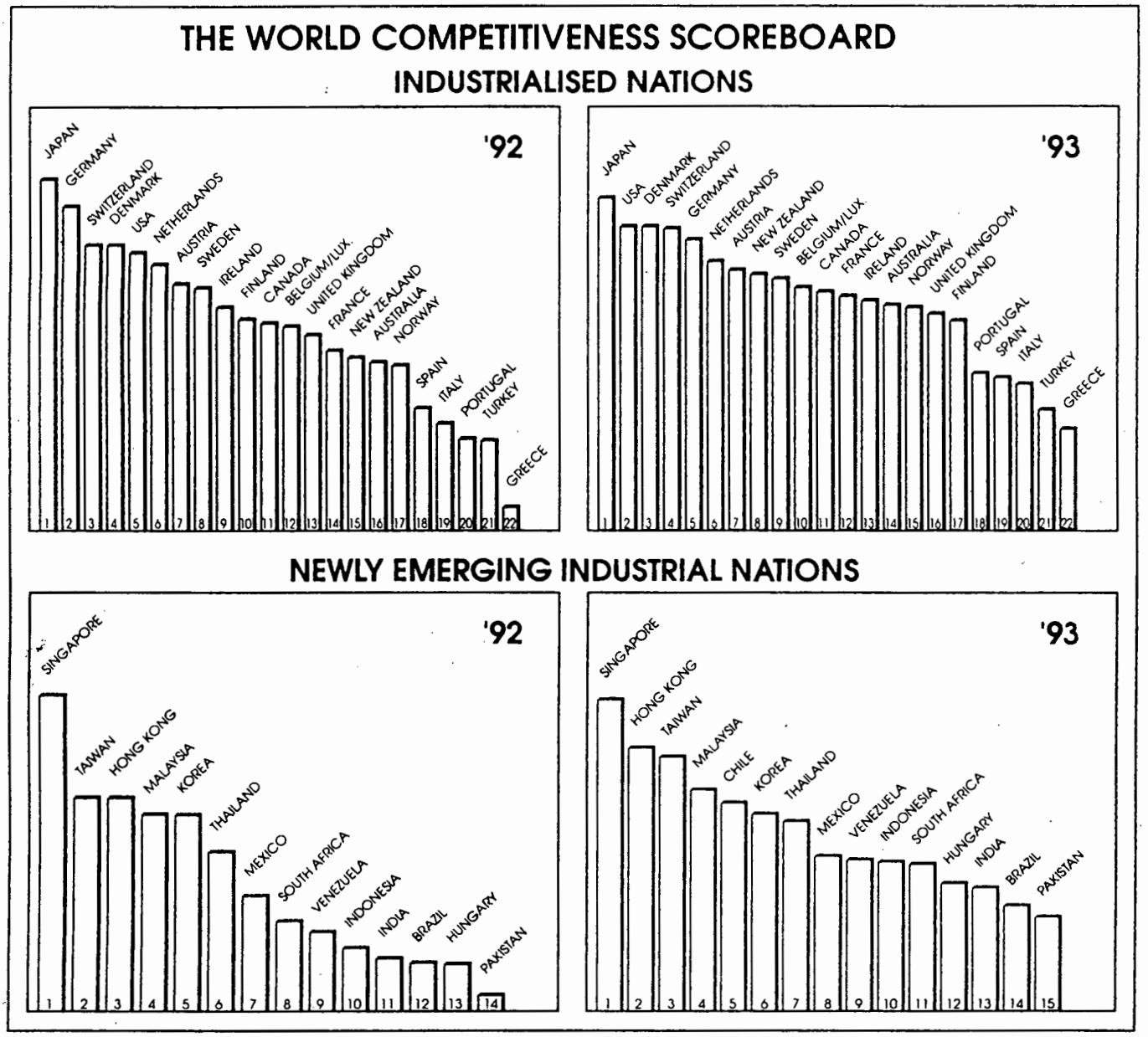


Fig. 1.11: Competitiveness of Newly Emerging Industrial Nations

Source: 1993 World Competitive Report

The comparison looks at performance in eight broad areas:

Sector	South Africa's Rating
Infrastructure	5th
Domestic economic strength	11th
Internationalism	13th
Government	14th
Finance	6th
Management	7th
Science & Technology	7th
People	14th

This trend is disturbing and again emphasises South Africa's need to improve its competitiveness.

This situation may not have affected manufacturing significantly over the past decade, due to the closed nature of the South AFrican siege economy. Sanctions have however recently been dropped and the world has now become South Africa's trading partner. South African companies need now to view themselves as global competitors (6) and must therefore become globally competitive.

If it is accepted that South African manufacturing is not internationally competitive and yet forms part of the global competitors, how can South African manufacturing become internationally competitive?.

2.0 Key Elements of becoming internationally competitive

2.1 Key Element 1 - World Class Manufacturing

Traditional western manufacturing organisations compete in terms of either cost, quality, service or flexibility. The Japanese however, have shown that it is possible to compete in all four dimensions at the same time. This total competitive strategy has resulted in Japan becoming a world leader in manufacturing competitiveness (as shown in Section 1.3).

The Japanese manufacturing strategy has become known as World Class Manufacturing (WCM).

If South African manufacturing organisations are to become WCM players and internationally competitive, it is important to understand how this development occurred.

2.1.1 Japanese manufacturing development

Japan has few natural resources, limited available land and a high population density (7). These factors have led to a need for manufacturing plants to be compact and efficient in the use of raw materials. In addition, the Japanese culture is one of attention to detail and frugality. Nevertheless, until the early seventies, the quality of Japanese goods remained inferior. How

then did Japan initiate and drive its quality improvement process?

"After World War II, American manufacturing was the only significant industrial capability left in the world. The Japanese manufacturing base had been destroyed and the quality of the few goods it produced was considered inferior"(7).

Due to the ravages of World War II, Japan was in a crisis situation with a large population, few natural resources and limited capital equipment or funds. An effective and efficient manufacturing base would therefore have to be developed to make use of the limited resources.

Due to this realisation, the Japanese Union of Scientists and Engineers (JUSE) was formed in 1949. The intention was to provide the necessary research and technology required for a manufacturing improvement programme.

It was known that Japanese goods had a reputation for poor quality and JUSE therefore invited the American Quality practitioner, W Edwards Deming to Japan in 1950 to assist in improving the quality of their manufactured goods (8). Other American experts followed and further developed the quality knowledge base in Japan. The Japanese realised that their prime competition would be the U S A and they applied their new found knowledge with almost religious fervour (9).

The objective of the quality improvement process was to reduce waste to the absolute minimum. Waste was considered to be anything that added no value to the finished product. This definition had the effect of questioning all processes and practices. For example, process waste which would previously have been considered part of the process and hence acceptable, was now considered in a new light and the process redesigned. This attitude to other aspects such as raw materials, labour, energy, floor space and time resulted in a steady improvement to the effectiveness of the manufactured goods and the efficiency of the process.

The manufacturing process was seen as a chain of suppliers and customers. Each "supplier" was determined to satisfy his "customer".

This all embracing approach to quality became known as "Total Quality Control" or TQC.

2.1.2 Total Quality Control

Quality may be defined as "Conformance to customer requirements" (10) and the objective of TQC may be defined as:

Continuous, incremental improvement, with a goal of perfection(11). The Western concept of acceptable quality levels (that is an acceptable level of defects) is rejected.

To achieve this continuous improvement, a change in philosophy regarding quality is required. Traditionally, quality has been the responsibility of the Quality Control Department. The Japanese challenged this and made quality everybody's responsibility. Many factors (12,13,14) have led to this approach being successful, they may be categorised under the following broad headings:

* Ownership

The responsibility for quality lies in the worker's hands. Any errors caused by an employee must be corrected by that same person to entrench accountability. In the manufacturing context, the production worker has the power to stop the production line as defect prevention is always better than inspection.

Groups of employees (supplier/customers) meet regularly to discuss their relationships with particular reference to defects and what can be done to prevent them in future. This is also relevant to external suppliers, who should be kept to a minimum and nutured.

* Measurement and Visibility

For the continuous process to remain motivated, people require feedback regarding changes and improvements. This feedback must

be simple and immediate.

Simple measurements of quality must be implemented and displayed on the factory floor. Any improvements through projects must be recognised and highly acclaimed on boards, lights, magazines etc.

Statistical quality control is used to ensure that processes remain within the operating window. These control charts must also be visible for all to see. Fault diagnostic charts to help return processes to specification are also often used.

* Role of the Quality Department

The quality department's role has shifted to a training and facilitating function. Through formal training programmes and constant quality auditing the quality department entrenches standards of perfection and prevention rather than cure.

In addition, the quality department will provide the experts required to set up statistical quality control, feedback boards etc. The experts will be the driving force behind the improvement process.

* Production Philosophy

If production workers have the power to stop the production line, customer's orders may be late, clearly this is unacceptable. The factory must therefore be scheduled at less than full capacity,

extra equipment is considered a cost of doing business. Through providing quality products and customer satisfaction, it is believed that the business will grow to fill the excess capacity. As this occurs new capacity should be purchased.

In addition, machines must be thoroughly maintained to prevent defective production.

Schonberger states "there were many minor players in Japan's ascendancy as an industrial power. I think there is no question about the star player: quality". (15)

Whilst this is probably true, the application of the techniques of Total Quality Control were not the only paradigm shift in Japan's approach to manufacturing. It was realised that Inventory is a risk to any TQC process. Any inventory, either in raw material, work in progress, or finished goods could possibly contain defective products, stop production and frustrate customers. Emphasis was therefore shifted to inventory control or Just in Time Production (JIT).

2.1.3 Inventory Control

As mentioned, inventory is always at risk in terms of quality. If however, the inventory holding can be reduced to one production unit, the risk can be minimised. This unit may be a

process batch or transfer batch where a process batch is defined as requiring set up and a transfer batch does not. Ideally the inventory holding should be one production item. For example, for assembly of a widget, only one subassembly of each type should be work in progress during the assembly operation. The worst case therefore, is one faulty widget. In the more continuous operations such as weaving, paper production etc, transfer batches must be held to the minimum and may relate to a unit of time, that is one production shift.

In addition to the quality implications of inventory, interest charges and floor space costs are incurred due to inventory. It was also realised that work in progress hides machine inefficiencies, breakdowns and poor scheduling through acting like a buffer. The Japanese intention was to fundamentally improve production and therefore preferred to expose weaknesses and not cover them up via inventory (16).

An analogy highlighting the risks (17, 18) of inventory is shown in Figure 2.1.

Only by reducing the sea of inventory will the threat of scrap etc be visible and force action to be taken to correct the situation permanently.

By reducing inventory to the absolute minimum with a goal of one unit, costs are reduced, lead times improved and flexibility enhanced.

The implementation of TQC and JIT cannot be undertaken by experts. There are too many continuous, small improvements to be carried out for a team of experts to handle. In addition, many of the changes are subtleties only known by the operators. These subtleties and their related improvements must be carried out by the operators as far as possible and experts called in (by the operators) only when necessary. By this symbiotic mix of operators and experts, the improvement process can continue.

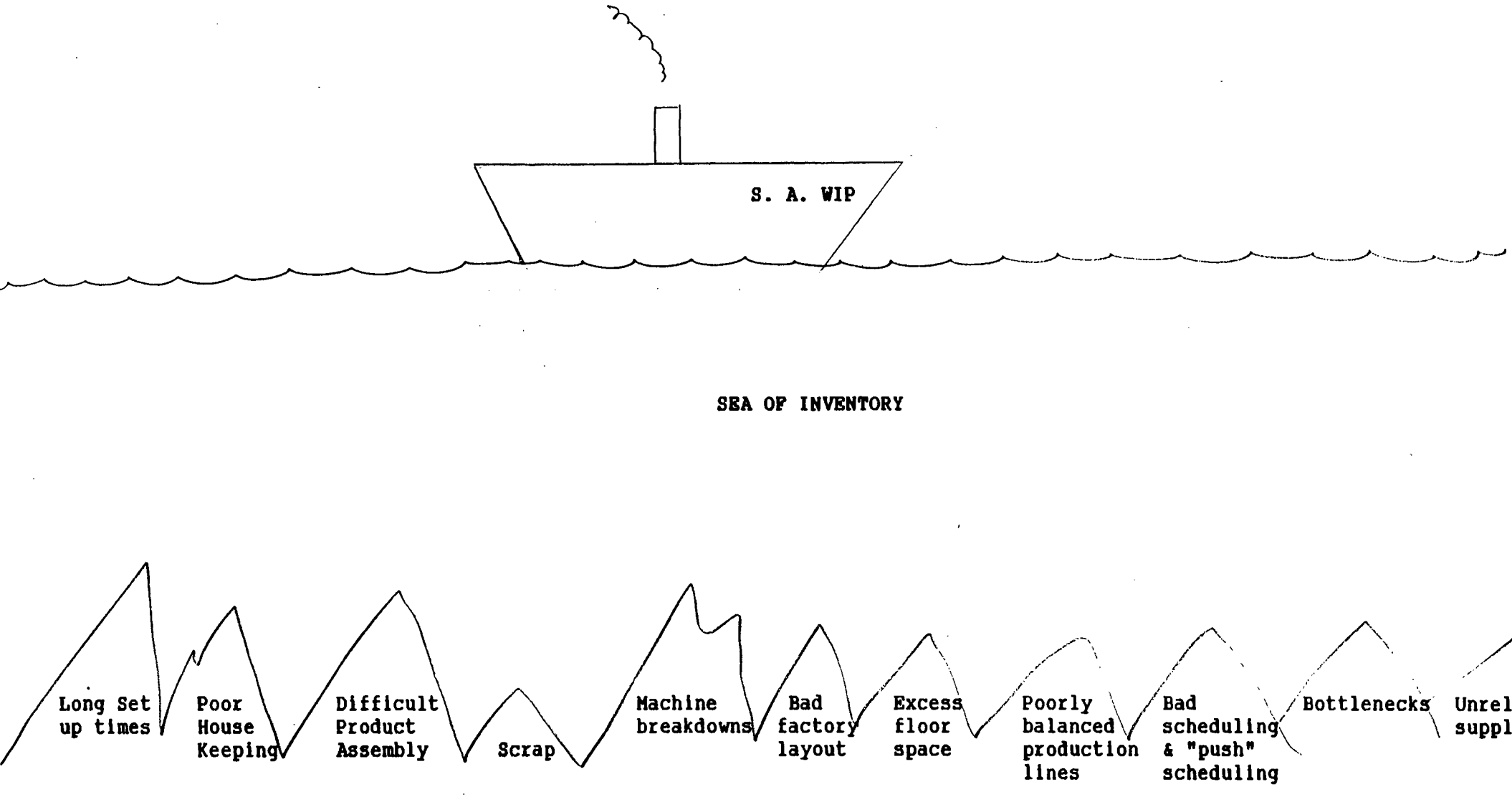


FIG. 2.1: The Sea of Inventory

2.1.4 Employee Involvement

If employees at all levels are involved in the improvement process, the synergy created (20) drives the process forward. Management or experts must be involved but operators must be relied upon for input and questioning in the strategic planning process. Through this involvement, a shared vision of the company and its future is created. This is crucial for co-ordinated action and improvement. In the early phases of the improvement process, employees operate as individuals, performing their particular tasks. Through the employee involvement schemes, purposeful groups develop. Employee involvement (EI) has taken many forms and names, the most comment being Quality Circles (21). In addition to developing a shared vision, quality circles benefit the employees through dialectic discussions and a learning experience. This learning is focused on the workplace and benefits both the individual and the organisation. The application of newly found knowledge results in quality and cost improvements providing further motivation for learning. A self perpetuating feedback loop (Fig. 2.2) is formed with significant long term benefits for the organisation (23, 24)

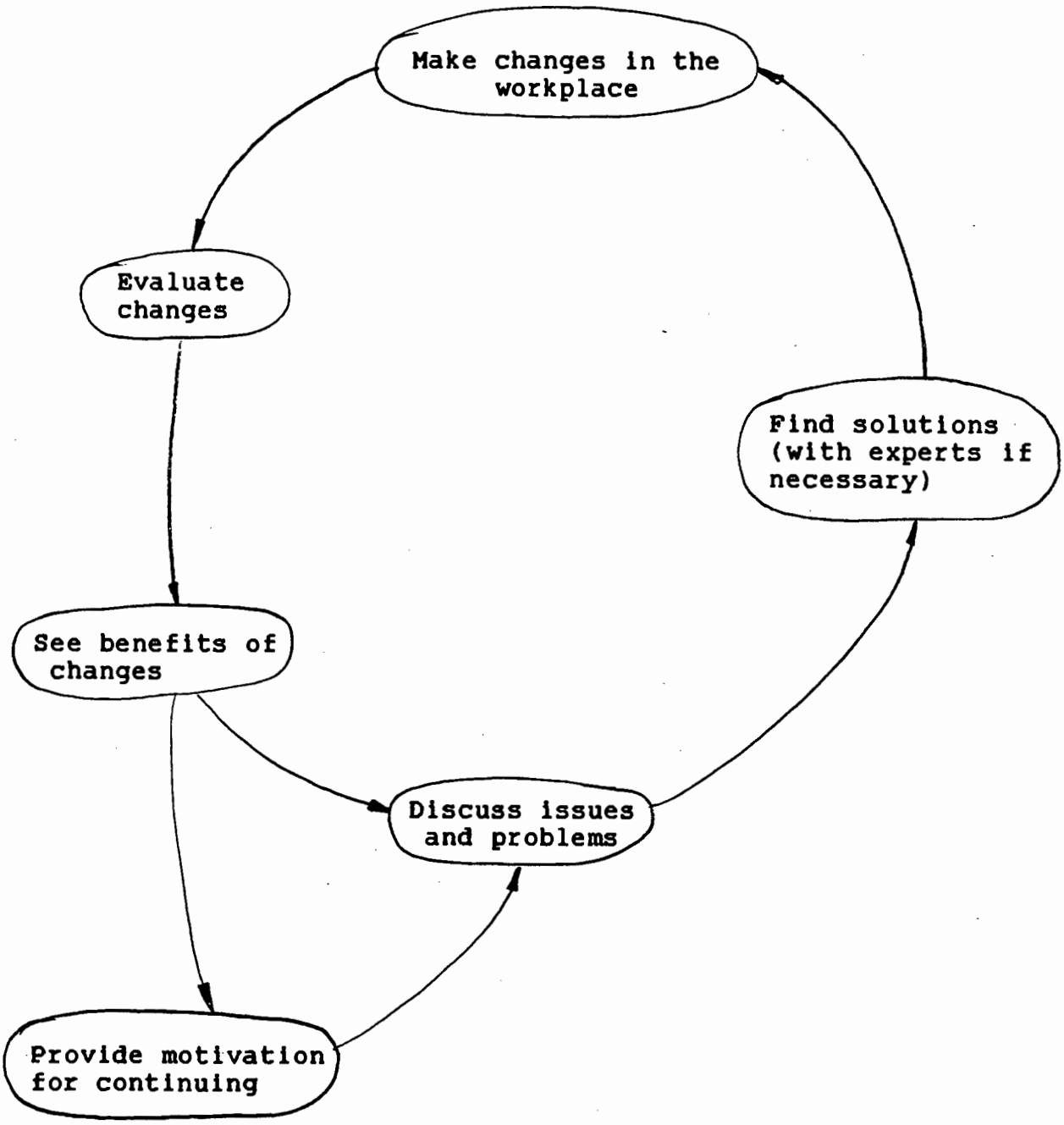


Fig. 2.2: The Learning Feedback Loop

Embarking on a "JIT programme", "Quality Circles" or "Quality Improvement Programme" in isolation, while possibly being of some benefit will not lead to an emulation of the Japanese manufacturing system. All the approaches must be considered simultaneously (25).

As mentioned earlier, WCM organisations are able to compete in the four competitive dimensions of quality, cost, dependability and flexibility. A model of how the benefits of TQC, JIT and EI impact on these four dimensions has therefore been developed (Fig. 2.3).

The model helps provide insight into how TQC, JIT and EI contribute synergistically to improving quality, dependability, flexibility and reducing cost.

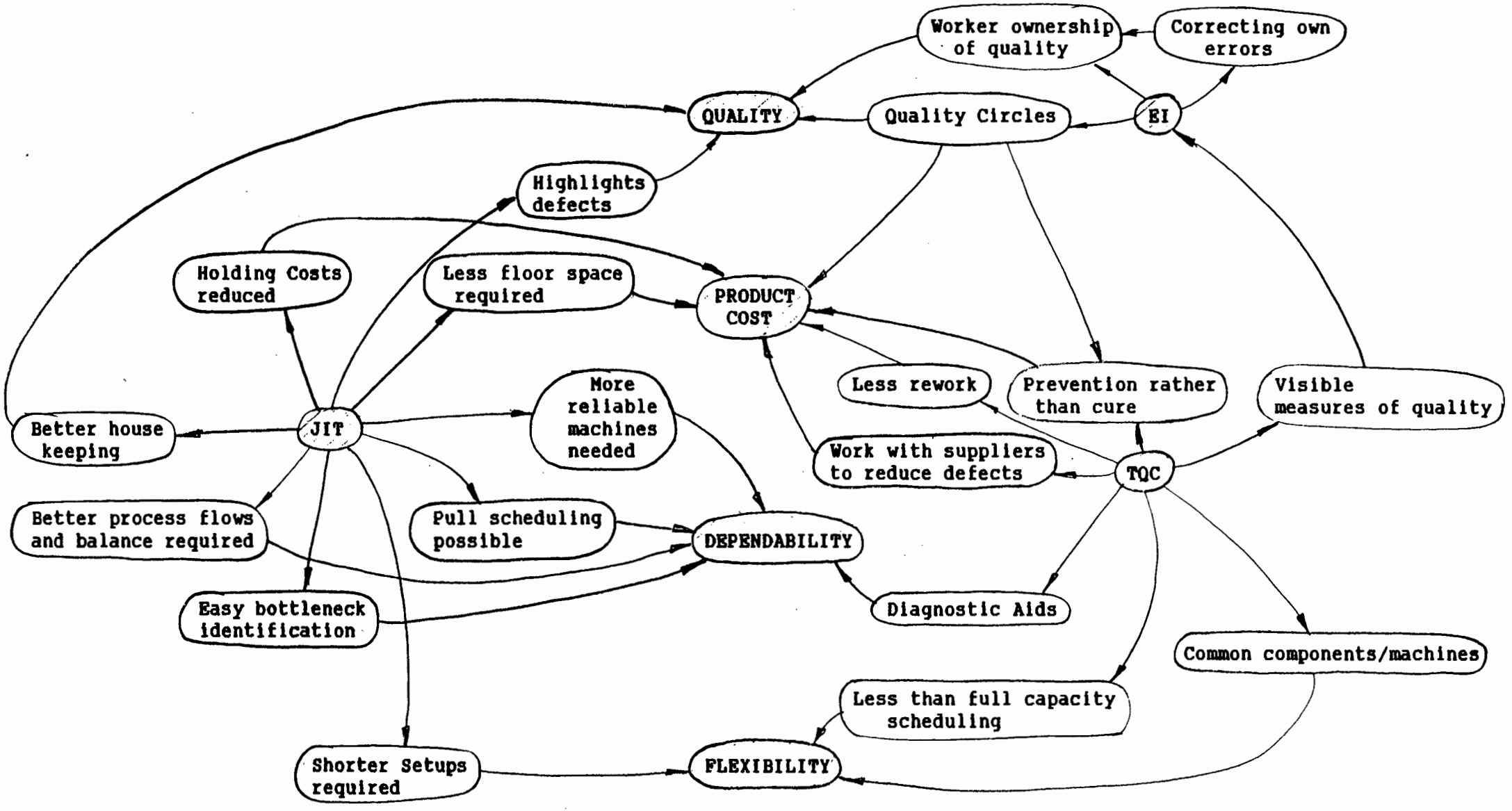


Fig. 2.3: The Interactions of TQC, JIT and EI.

Through the integrated application of TQC, JIT and EI, many Japanese manufacturing organisations have evolved into World Class Manufacturers capable of competing on all four competitive dimensions.

This evolutionary process is shown graphically in Fig. 2.4 and warrants some explanation.

At the corners of the triangle are Shared Vision, Total Involement and a Systemic Approach.

The Shared Vision of the future is necessary to ensure that all stakeholders in the improvement process have similar, compatible values and goals. Clearly this is crucial if people are to work synergistically together. Total involvement includes Employee Involvement and External Involvement. That is, forging relationships with suppliers, customers and Government, all stakeholders must be involved in the evolutionary process.

A systemic approach is based upon seeing both the woods and the trees in a complex situation and exploring fundamental solutions rather than symptomatic ones. In addition, it is important to realise that manufacturing interfaces closely with external customers, suppliers, sales, finance etc. Production cannot be thought of as a closed systems with raw material and labour inputs resulting in product outputs. Small changes in the

manufacturing can have significant effects on the environment, and vice versa.

The various cronological phases of Japan's emergence as a world leader in manufacturing have been included, but are self explanatory. The triangle is built up by each layer of experience resulting in development and hence capability to tackle the next layer of complexity.

At the apex of the triangle, world class manufacturing is described as an ideal seeking, self organising system. This may be thought of as a largely self managed (on a daily basis) synergistic body of individual people seeking to serve their customers and develop new markets and themselves. It is important to realise that WCM companies are part of the marketplace and yet realise that they are capable of influencing the market.

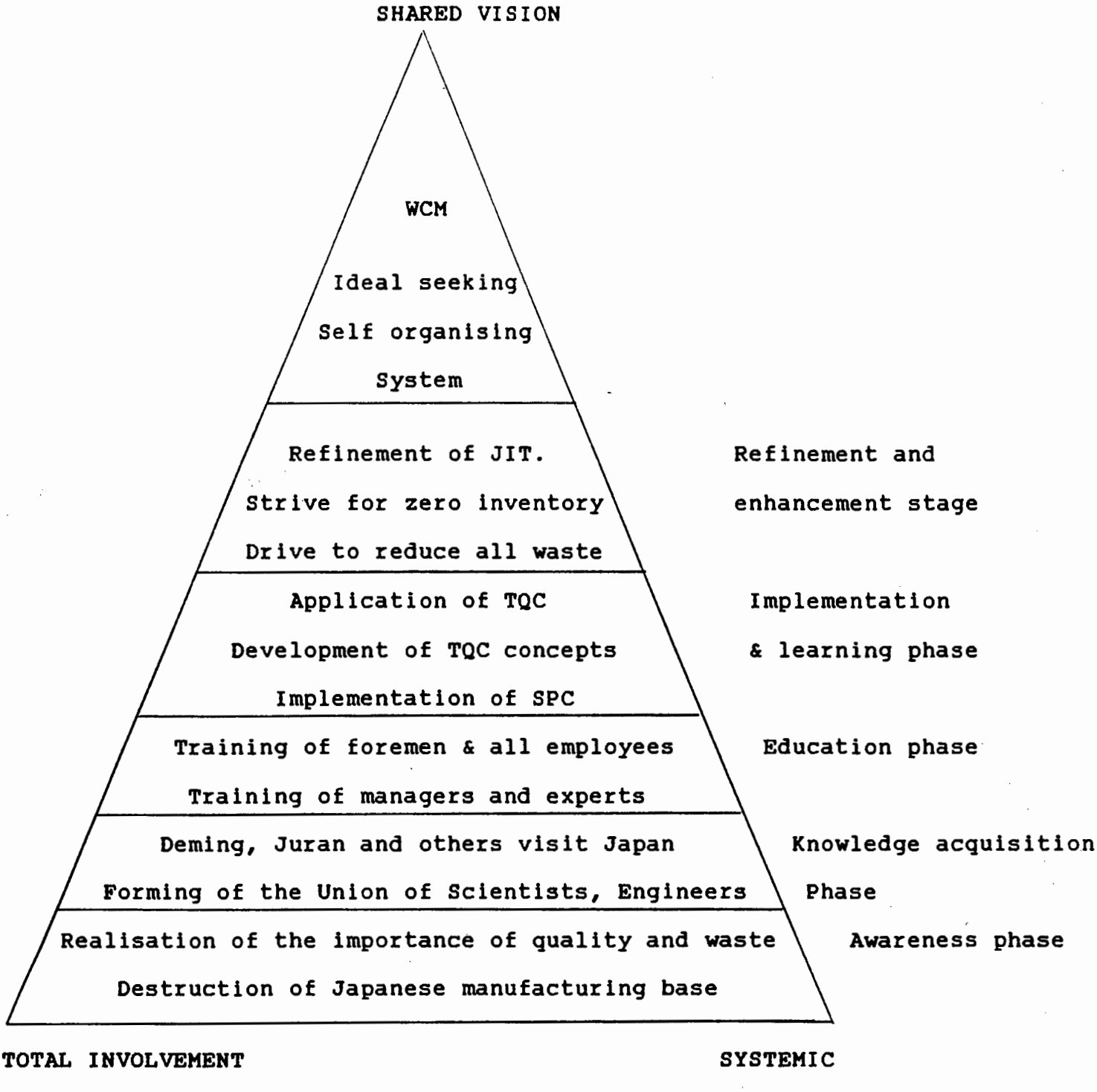


Fig 2.4: Graphic Representation of the Japanese Manufacturing Evolution

2.2 Key Element 2 - A Systems Theory of Organisations

If an organisation is to be managed through a change process, it is important to understand how an organisation functions. This understanding may be enhanced by using models to gain insight into the dynamics of an organisation. Three models will be discussed and their increasing complexity and "degrees of freedom" will be contrasted.

The intention is not to argue which model more accurately reflects a particular organisation, but to explain the differences in capabilities of organisations most closely resembling the three models.

For ease of reference a summary of the models and their organisation and management is shown in Fig. 2.5.

2.2.1 The Mechanistic Model

Ackoff describes the mechanistic model of an organisation as:

"a hermetically sealed clock, made up of purposeless and passive parts that operate predictably. Any deviation from regularity is reacted to with changes that restore it. The system is believed to tend in the long run toward a static equilibrum" (26).

People are thought of as cogs in a complex machine. Each cog has its function and the output of the system is dependant upon these

cogs. The cogs however perform purely their defined function and cannot move or change independantly of others. They are mindless and all actions are dependant upon the head.

It is important to note Ackoff's belief that the system eventually becomes static. This tendency is due to the organisations inability to develop or grow as the environment changes.

A mechanistic approach involves job classification and a reductionistic approach to work organisation resulting in machine-like work practise. Rules and regulations are an integral part of the mechanistic model resulting in a mindless, non self improving organisation (27). Ford's mass production methods would be typical of a mechanistic organisation.

Mechanistic management arranges the work funtion and individuals into a machine like operation and strives for efficiency.

A mechanistic organisation works well in a static environment but is not well suited to change, particularly of an external nature.

The mechanistic model is "state maintaining" in that if the environmental conditions change, it attempts to maintain its state and is therefore ultimately eroded by change. It cannot learn as it cannot choose its behaviour.

2.2.2 The Organistic Model

In the organistic model, the individuals are considered to be organs and senior management the brain of the organisation.

Each organ has a clearly defined function in terms of overall survival but cannot operate independantly of other organs or the brain, the organisation may be said to be uniminded. However with exercise, or based upon a particular need, organs may grow or fall into misuse and atrophy. The individuals (organs) have more skills than the mechanistic model and are not as easy to replace (28).

The system is hierachically organised but control is not as centralised as in the mechanistic model. Rules and regulations exist but are not as rigid and are more likely to change according to the environment to ensure survival. Change is considered evolutionary and dependant upon external needs. Control is based upon output rather than the mechanistic input control. The outputs are specified, however the means of achieving the desired goals are not as clearly defined.

Ackoff uses the analogy of a motor car for the mechanistic model and a horse for the organistic model.

"A horse, unlike a motor car, cannot be driven into a wall without compulsion" (29).

The mechanistic organisation will blindly follow its leader to destruction, members will not even be aware of the danger of the leader's direction. This may be compared to the organistic model where the members will follow the leader to a certain point of danger, become aware of the danger and turn aside, irrespective of the leader's persuations to continue ahead.

An organistic system is "self maintaining" as it responds to changes in the environment in various ways for the same stimuli based upon its previously learned experience. The overall goal is to return to its original outputs but choose its means.

Organistic management considers growth necessary for survival and uses its employees to achieve this goal. The overall objective is to try to predict a future (over which they have no influence) and to prepare for it.

2.2.3 The Social System Model

The various parts of the social system model are considered to be individuals, each with their own free will and responses to situations. It is possible for the social system to produce different outcomes from the same inputs and vice versa. It may be considered a multiminded organisation.

Because of the complexity of such a model, the interactions between the various individuals require management effort, more

so than in the previous models. The detail work is self managed by the individuals.

Rules and regulations take the form of social norms and standards and are adapted almost unknowingly, dependant upon the external environment.

The social system is driven by the need to create and develop, not just grow.

A social system is "purposeful" and changes in the environment will be considered and free will exercised to develop the most effective and efficient response. Through creation and development, social systems remain stable (30). Social system management is concerned primarily with development through learning and creating new outputs which help to shape the future and hence the environment.

Although the models are hierarchical from the simplistic mechanistic model through to the more complex social system, reality would be more accurately reflected by some mix of all three.

It is important to understand the evolutionary nature of organisations, starting with the mechanistic model and over a period of time evolving through the organistic model into the social system. The organisation then has an ability to influence the future and not merely attempt to maintain its desired output.

It should be noted that the evolutionary process is not necessarily natural in that it will always occur. Evolution is by definition a change to somthing that works more effectively or efficiently. Evolution will only occur if there are benefits to be gained from it.

Mechanistic	Machine like activity Mindless Autocratic, disciplinarian management Job classification Many rules and regulations Authority separated from the masses Blind adherence to instructions expected Suited to static environment State maintaining Strives for efficiency Control based upon inputs
Organistic	Activity similar to an organism Uniminded Masses follow the lead with some local authority Hierachically structured Rules and regulations more flexible Evolutionary change possible Goal seeking Suited to slowly changing, predictable environment Strives for survival and growth Control based upon outputs
Social System	Many individual activities Multiminded Automanagement - people manage themselves Rules take the form of social norms and standards Circularly structured Driven by the need to create and develop Influences the future and the environment Development through learning Purposeful systems

Fig. 2.5 Mechanistic, Organistic and Social System Models

2.3 Key Element 3 - Levels of Existence - The evolution of an Organisation

To further understand organisational development, Grave's Levels of Existence theory has been reviewed (31, 32, 37).

In his paper "Levels of Existence: an open system theory of values", Graves states (31, P132)

"That man's nature is not a set thing, that it is ever emergent, that it is an open system, not a closed system.

That man's nature evolves by saccodic, quantum-like jumps from one steady state system to another.

That man's values change from system to system as his total psychology emerges in new form with each quantum like jump to a new steady state of being".

Adding to this, Graves believes that man changes his psychology as the conditions around him change. He is, in effect, a product of his environment.

Taking this further, at a particular level of existence, a person faces specific existential problems. These problems are pertinent to survival, growth and "being" at that time. The existential problems are managed by developing an ability to cope with the situation. The coping ability is specific to the existential problems and is not relevant to more complex situations. The individual is not aware of (and does not have the ability to deal with) problems outside their current visual existential situation.

Once the person has learned to cope with the current existential problems, he has spare brain capacity and may become aware of new existential problems. This leads to the potential quantum jump up to a higher level of existence.

External factors such as the economy, politic, social interaction all contribute to the existential problems. In the manufacturing context, problems are hierachical from simple pick and place decisions to defect prevention and strategic issues.

It should be noted that the individual or the organisation is part of the environment and therefore has his own influence on the environment. This is shown as the feedback loops in Fig. 2.6.

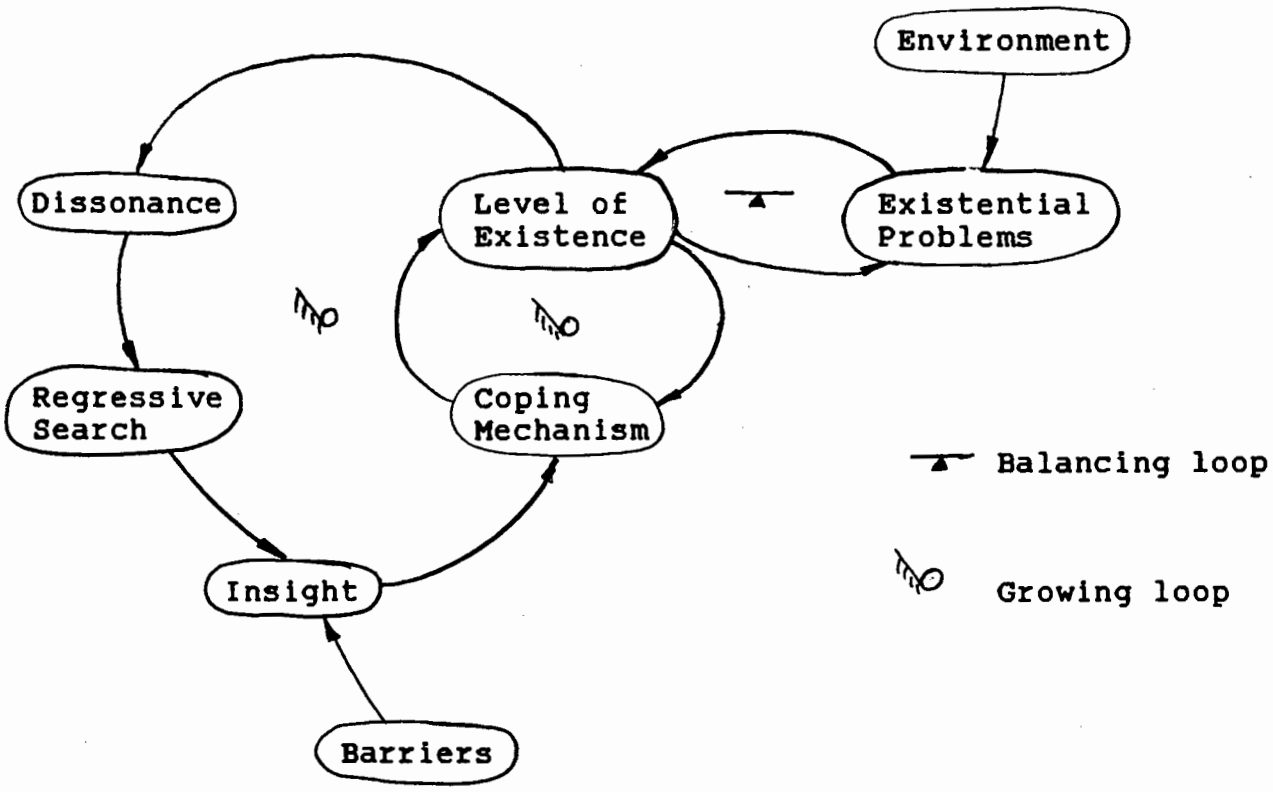


Fig. 2.6: Levels of Existence Feedback Loops

The coping mechanism loop is a "Growing action" feedback loop (33). As the coping mechanism develops, a higher level of existence can be reached through solving problems. However, a "limits to growth" balancing loop slows the growth process as new more complex existential problems develop due to the current level of existence. The external environment can speed up or slow down the climb up the levels of existence depending on the effect on the existential problems. Dissonance and free energy must be present at the transition from one level to another. In addition, at the point of emergence to a higher level, the current solutions to the existential problems are no longer effective or efficient. This leads to dissonance and a regressive search through previously learned solutions to the problem. This search may end in arrestment, regression or growth depending on external factors. If the individual has insight into a new solution and overcomes external barriers (such as peer pressure) the jump to the next level can occur.

Considering the work of the National Values Centre, it is an extension of Graves' levels of existence theory but is applied more generally to individuals and groups.

Three principles apply:

A. A point of equilibrium exists due to the conjunction between existential problems and the coping mechanism in the brain.

B. Each point of equilibrium reflects how people think, not what they think. A complete value system develops around the specific view of the world.

C. Each point reflects ways of thinking, not types of people. All people have the ability to move from one state to another, given the corresponding existential situation.

The stages are not considered discreet but more a congruence of situations and response through time. It is however hierarchical to a large extent in that the individual or group learns more about their existence by experiencing a particular point of equilibrium. Indeed it is not possible to "jump" past any of the various "states". They are essential learning experiences.

It is useful to consider the summary of the two concepts (Fig. 2.7) to help identify at what level of existence an organisation currently occupies. In addition, the mechanistic, organistic, social system models have been included, showing how the various levels of existence conform to the models of organisations. For example, at the survival sense level, life is reactive and automatic, that is, mechanistic. Conversely, at the flex flow level, individuals are considered in their own right, that is society is a system of individuals similar to the social system model.

The organistic model would best describe the Truthforce level of existence.

G-P	Power Gods Egocentric Exploitive Hedonistic Macho Haves/Havenots	To have power in an aggressive world To respond quickly to threats and maintain respect To escape the pull of tribes and and assert independance regardless of what others think	Self expressed by aggression amoral, guiltless and uninhibited fashion Trust no-one, depend on self Use any means to exploit others and live on in their hearts and minds	Empire Structure Power orientated strongest survive Most powerful person makes decisions Big boss directs work bosses who drive the masses Communicate downwards only Strength determines relationships Feudal
B-O	Kinspirits Tribalistic Animalistic Superstitious	Hold on to the ways of the elders Defend the chief/tribe Willing to sacrifice self in the name of the tribe Future kin protected through the tribe	Reliance on totems, rituals etc. Find ways to placate the spirits Participate in the tribe and accept and be proud of one's role.	Circular Tribal Structure Led by chief Roles determined by kinship, sex, age and strength Ways of tribe are sacred & rigid. Absolute obedience
A-N	Survival Sense Reactive Automatic	Satisfy basic physiological needs Deal with life's survival issues	Move rapidly with shifting resources in order to reproduce Exist in bands Struggle and use instinct to survive	Herd like Strong members protect weaker ones Movements dependant upon external factors Little influence on environment

mechanistic

Fig. 2.7 - Levels of Existence (25)

Level	Description	Existential Situation	Coping System	Organisational Behaviour
G-T	Global View Global Order Renewal Revised spirituality	To reduce threats to living systems To implement meta-solutions and build awareness of common destiny Foster global thinking and collective actions against hunger and disease	Establish worldwide networks Abandon traditional human barriers Sacrifice if necessary to maintain quality of life within the capabilities of earth	Global Flex Preserves & renews from macro level Blends consensus and competency in meta management Instant communication flow Self & greater interest sub... for greater good Each entity seen as global initiative
H-U	Flexflow Systemic Existential Concern with resources depletion	To deal as an individual with a complex world of diminishing resources To live a functional life in a rapidly changing world To explore ways to restore earth's viability	Views the role of humankind systematically Emphasises flexibility, tolerance & self motivation De-emphasises status and group allegiance May not accept traditional values.	Functional Flow Structure according to task at hand Project centred with changing functional leadership Competent person makes decision Communication only as needed May adopt BO through FS if needed
F-S	Human Bond Personalistic Relativistic Guilty about the havenots	Stop exploitation and manipulative materialism Come to peace with inner self and make contact with similar people Erase from earth, poverty, racism etc. through the universal family of humankind.	To develop the capacity to get inside oneself To be sensitive to the feelings of others Promote human themes Whole person enrichment schemes.	Social Network Organisation of equals for mutual benefit Little concerns with status People make decisions as a group Frequent communication in all directions Emphasis on consensus
E-R	Strivedrive Materialistic Multiplistic Industrialised World Hightech Energy dependant	Create a better life by using any available resources Escape fatalistic dogma by looking for the "best" way to control human destiny Create mechanisms to spread the materialistic way to other deserving people	Develop the scientific process Rely on technology to solve problems Trust the free market system Reward those who take risks and do well Use material evidence of success for incentives	Active Hierarchy Bureaucratic & status orientated Person with delegated authority makes decisions Responsibility distributed Carefully Communication, up, down & across Power related to position Allows for upward mobility
D-Q	Truthforce Absolutist Saintly One right way	To find the true meaning of life To bring order to the world through classification into good and evil To control impulsivity Suffer the pangs of life to prove worthiness & prepare for death	Seeks to live in the right way Rigid law enforcement agencies Charity programmes for the needy Crusades against evil	Passive Hierarchy Rigid rules for structure & rank Person with appropriate position makes decisions People stay in the rightful places Divine authority Secular authority Communication downward & horizontally

social system

organistic

2.4 Synthesis of the Key Elements

Evolution

"Origination of a species by development from earlier forms" - Oxford Dictionary definition.

If one considers the key elements discussed, that is the Japanese manufacturing development, organisational development and the levels of existence theory, all three are evolutionary in nature. That is, the changes that occur, can only happen because of a previous change. In addition, the changes occur because they work, that is the system is better off than before the change. The changes may therefore be considered development or evolution.

It is worth returning to the evolution of Japanese manufacturing and synthesising it with organisational models and the levels of existence theory.

This is shown in Fig. 2.8.

It has taken the Japanese almost forty years to develop from manufacturing barely acceptable, and largely copied products, to the multinationals such as Sony, Toyota etc. with reputations for superb quality, cost competitiveness and innovation.

During this evolutionary process, they have moved from a mechanistic organisation to the present multiminded, social

system. Throughout this process, the problems that the manufacturing organisation's employees have had to face have become more and more complex. As the employees have learned to cope with the more complex situations they have moved up the levels of existence ladder enabling them to cope with even more complex issues. It has been a slow upward spiral for World Class manufacturers.

The energy for change, has come from the process itself. Grave's levels of existence theory makes it clear that people do not operate at one level for all time but are "ever emergent" and rise to higher levels of existence or possibly regress to lower levels. The return in terms of material goods and wealth is such that regression is, however, unlikely. Benefits are to be gained from the evolutionary process which therefore continues.

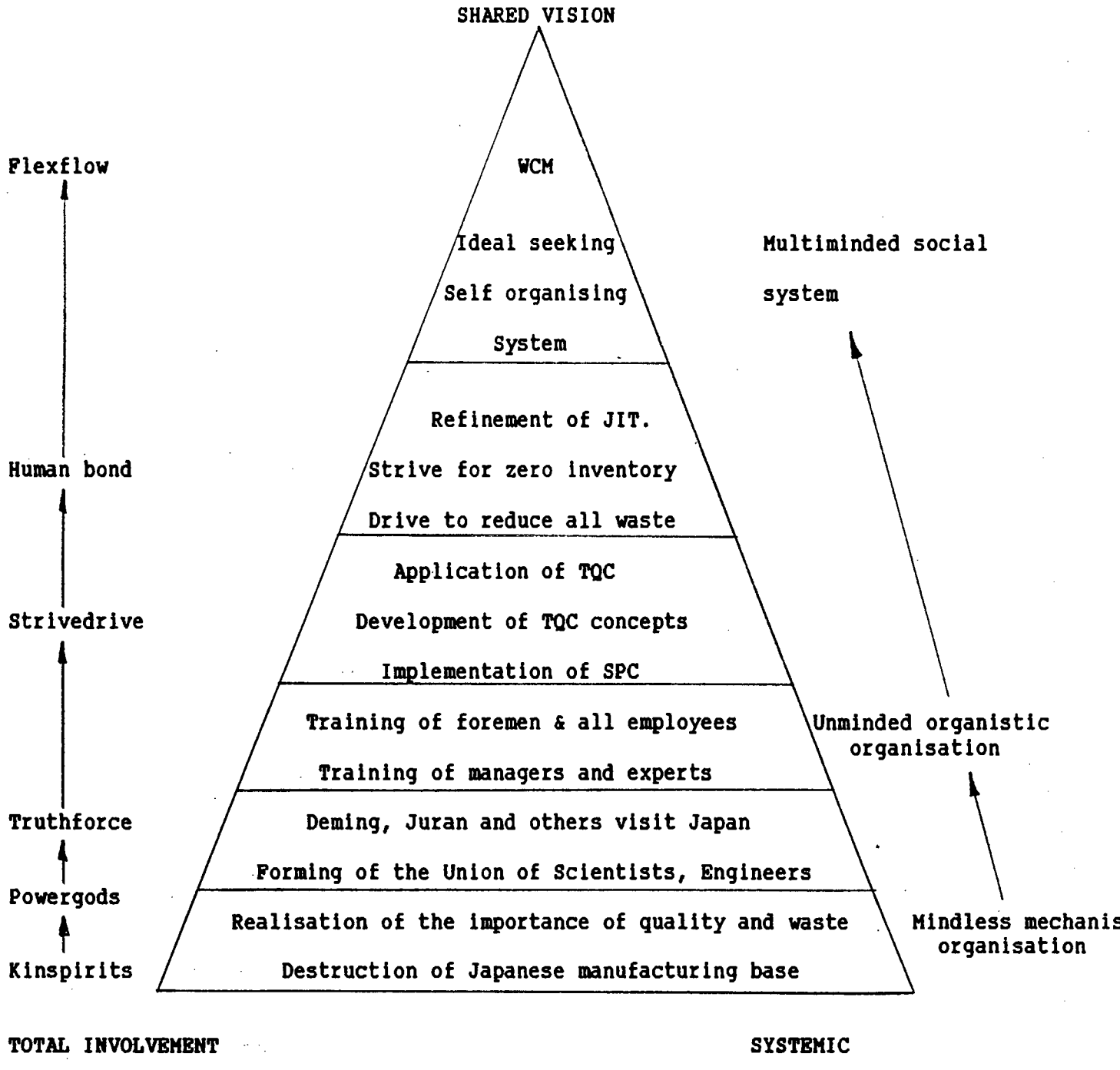


Fig. 2.8: Systhesis of Japanese evolution, Organisational Models and Levels of Existence

2.5 Question 2 - HOW CAN WE SPEED UP EVOLUTION?

It appears reasonable to accept that South African manufacturing needs to evolve into its own version of World Class Manufacturing. The complication is however, that with the unstable political situation and the high population growth rate, economic growth in the manufacturing sector is urgently required.

South Africa does not have thirty years to evolve into a world player. The evolutionary process needs speeding up. How then can this be achieved?

Considering a number of well known approaches and the evolutionary nature of the process, a model for organisational learning and evolution has been developed. It is called the Coping Development Model.

3.0 Key Elements of the Coping Development Model (CDM)

Before discussing the Coping Development Model, it is worth considering the traditional approaches to applying JIT, WCM etc, as they all form part of the CDM.

3.1 Key Element 1 - The Systems Engineering Approach

With the increasing complexity of military equipment and the need for reliable performance, the American Department of Defence

developed the miliary specification Mil - Q - 9859 A(30).

This specification laid down the requirements for quality programmes related to the construction of military hardware. It is a detailed, written manual of procedures and infrastructures relating to conformance to specifications. An external auditor is used to ensure that the quality manual has been correctly written and is adhered to.

Similar quality specifications have developed internationally, for example:

- British Standard 5179
- South African Bureau of Standards 0157
- ISO 9000

All these systems have similar principles, namely:

* The quality related information required to ensure conformance to specifications is written in the form of a Quality Manual.

* Conformance is tested by review and feedback by the internal quality department

* An external auditor ensures consistency.

The document acts as a guide for quality improvement and a product and process specification manual.

Checkland describes the Systems Engineering approach as follows (50):

> "Define the system of concern.
> Define the systems objective.
> Engineer the systems to meet those objectives".

The system is considered to be goal seeking through evaluating the efficiency of alternative solutions to achieve an end which is known to be desirable.

The systems engineering approach is the "hard" paradigm of systems thinking and is well suited to the mechanistic organisation operating at a low level of existence. It has advantages in that everyone within the system knows what they are trying to do. It is however static in nature and not evolutionary. Typical control charts from SABS 0157 are appended (Appendix 2).

3.2 Key Element 2 - The Project Approach

The objective in the project approach is to identify non-conformances and to solve them on a project by project basis.

Non conformances are actions or products which are not to specification. The goal is perfection or zero defects.

The order of actioning the corrective measure is usually decided

by applying Pareta's 80/20 rule (34).

The improvement process is usually expert led with external training and considerable fanfare. A typical project approach is Crosby's Quality Improvement Process (10) where a Quality Improvement Team is set up to run the process.

Many World Class Manufacturing consultants use a project system based upon a pilot plant process improvement followed by large scale WCM initiatives, again expert led.

The project approach may work well in solving problems that are at a level of existence consistent with the employee's ability to cope. However, if the problems are above that coping ability they will not even be recognised as problems and higher level people (probably management) will have to take ownership of the problem. The employee will therefore not develop through solving these problems.

The project approach to quality improvement is suited to an organistic organisation with senior management running the process.

3.3 Key Element 3 - The employee involvement approach

Groups of employees (Quality Circles) are formally established to evaluate work practises or quality problems and suggest improvements. Management acts as a facilitator rather than an expert, the expertise is provided by the employee group or by a

consultative expert on the group's request.

Most of the previously described approaches include employee involvement, however the emphasis is not centred on employee groups. Quality circles emphasise employee involvement in solving their own problems. The emphasis is however not on learning but on problem solving.

The employee involvement approach would be effective in social system organisations where individuals exercise their wills in making improvements in the workplace.

3.3 Synthesis of the Key Elements

Do the Traditional Approaches Work?

A summary of the traditional approaches to implementing a WCM improvement process is shown below.

The Systems Engineering Approach

A rational system which clearly defines objectives and attempts to match the system to the objectives. Effective in a mechanistic organisation.

The Project Approach

An expert led approach which attempts to correct non conformances and strives for perfection. Effective in an organistic

organisation.

The Employee Involvement Approach

An employee group approach to solving their own problems. Effective in a social system organisation.

Graves' level of existence theory can be used to argue why the traditional approaches are bound to have limited success (36).

In any improvement process, the protagonists of the improvement process are operating at a higher level of existence than the majority of employees who have not developed the necessary abilities to cope with the new, emerging situation. Developing this further;

To quote Graves, "at any given level, an individual exhibits the behaviour and values characteristic of people at that level; a person who is centralised at a lower level cannot even understand people who are at a higher level" (37). For any WCM initiative to succeed in the complexity of a manufacturing organisation clearly requires at least accurate communication and a shared vision. According to Graves this will not be possible across different levels of existence.

The author argues further that at any point in the continuous process of improvement leading to WCM, the organisation is operating at a level congruent with its existential problems and the requisite coping mechanism. The organisation' members, structure, management style, employee education level, technical expertise, process technology etc all contribute to maintaining the organisation at a stable level of existence. The organisation may even appear to be a closed system, independant of its environment and stable.

Any initiative to move an organisation along a WCM path will fail in the long term, unless the requisite coping mechanisms can be developed concurrently. Clearly defined objectives, strong leadership etc are insufficient to bring about the desired long term change. The organisation itself resists the change and in fact cannot cope with the change. Eventually the management energy required to support the improvement process wanes and stability returns to a level similar to before the changes. Long term changes can only be achieved by a systemic approach to the process, realising that employees are an integral part of the system and their ability to cope with the existential problems is critical.

In addition, a "quick fix" is not possible, the learning experience of becoming a WCM is an integral part of being a WCM company and indeed the means is more important than the ends.

Based upon the preceding argument, and South Africa's manufacturing sectors need to become internationally competitive, a model for guiding an organisation through the evolutionary change process was considered relevant.

The model should have the following elements:

* well defined product/process specifications to enable problems to be identified.

* capable of operating in and evolving through, a mechanistic, organistic or social system environment.

* Should focus on learning rather than on problems to ensure development and not only growth

* Should take into account Graves' levels of existence theory by developing an organisation's ability to cope.

* The model must form an integral part of an organisation's strategic planning to ensure that as the organisation evolves, the model evolves with it.

* It must provide the necessary framework for stable operation

* It must be iterative and continuous but with formal review to measure its effectiveness.

A model consistent with these requirements has been developed and has been called the Coping Development Model (CDM). Before developing the model in detail, an introductory model structure will be discussed.

Planning: Planning methodology (38) is used to decide and plot what direction the company should take.

Restructuring: The organisation requires a structure consistent with its process and its people. A process driven structure with people operating at similar levels of existence at similar hierachial levels is therefore required. Supervisors and managers should act as mentors and should only be a maximum of one level of existence higher than their respective staff.

Learning through Problem Solving: Operational problems must be solved using a combination of problem solving techniques and systems methodologies. By solving these problems, the employees learn and develop.

Moving to a higher level of existence

The current level of existence of the organisation and its members needs to be assessed to prepare for the next planning session.

The stages of planning, restructuring, problem solving and level assessment interface together as shown in figure 3.1. The model is iterative and typically completes a cycle annually. A facilitator has been shown in the middle of the loop. The facilitator's role is to ensure that the coping development model stays on track.

The four stages of the model and the role of the facilitator will be discussed in more detail in the next chapter.

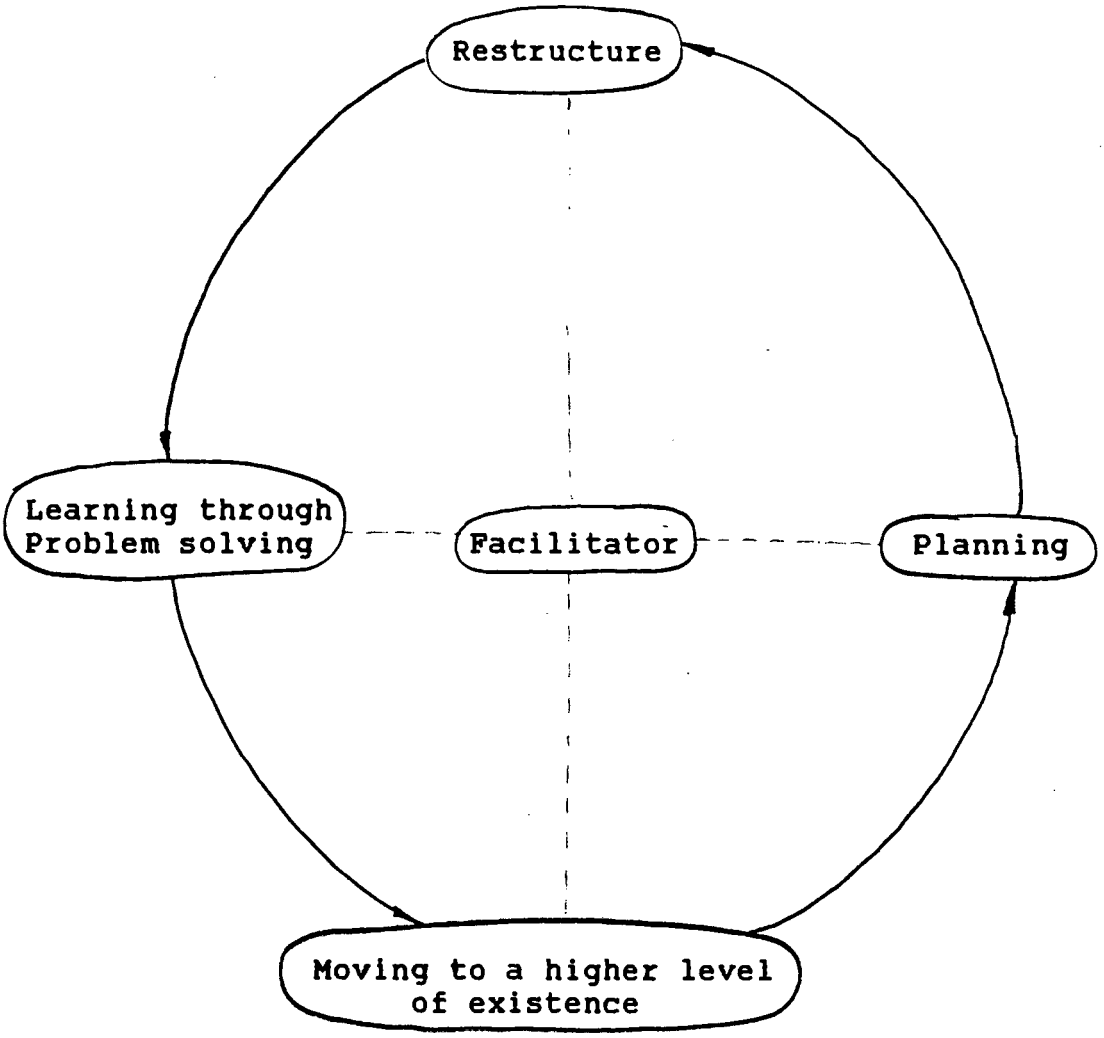


Fig. 3.1: Coping Development Model

4.0 The Coping Development Model

4.1 Applying the Model

It is important to realise that the focus of the model is on developing the organisation's ability to cope with the more and more complex situations associated with World Class Manufacturing. This implies that the organisation is climbing up the ladder of levels of existence and hence learns to become a world class manufacturing company. The improvements in quality, flexibility etc are part of the evolutionary learning experience and are not the ends, but part of the means.

The model is designed to be self-sustaining and consists of a growth loop and a balancing or limiting loop. Senge's system architypes have been used to explain the system feedback (33). This is shown graphically in fig. 4.1.

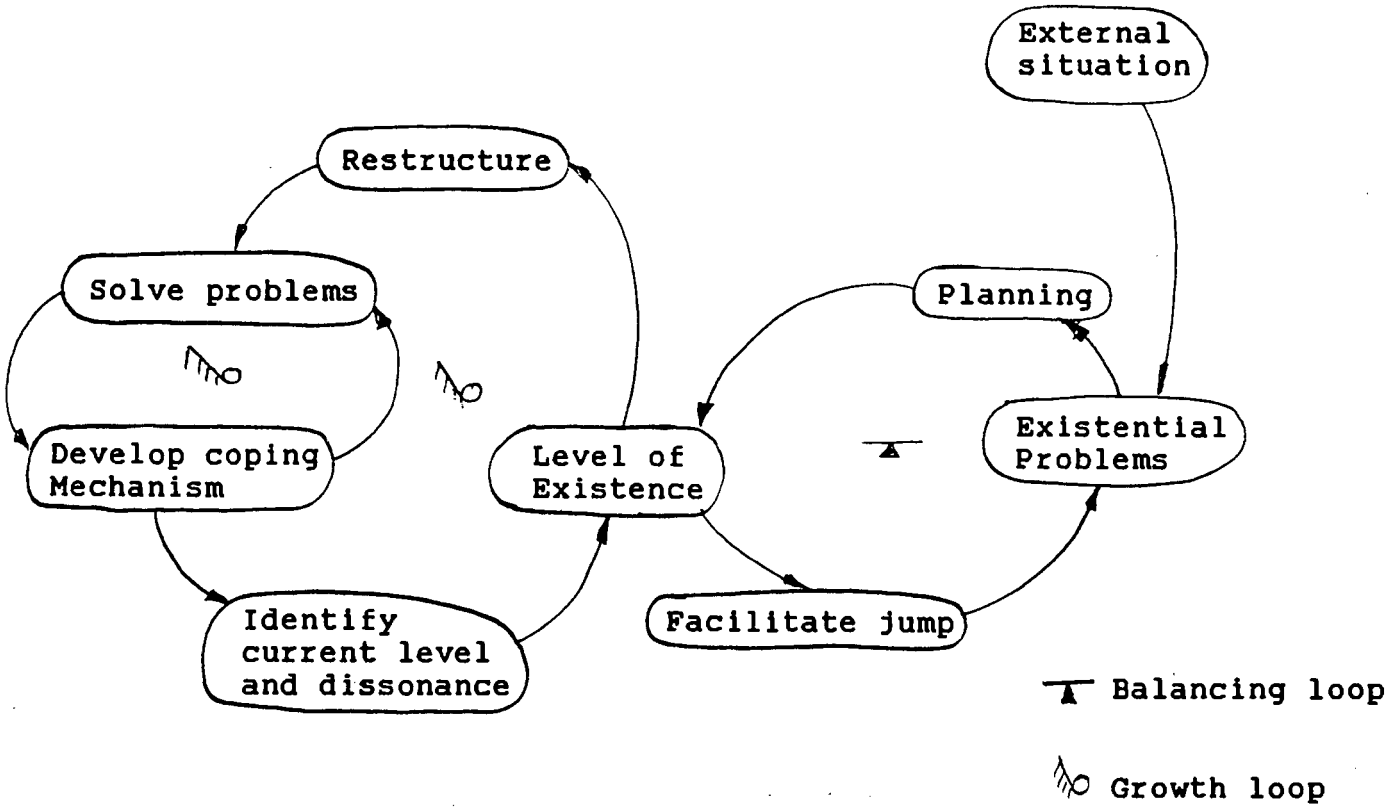


Fig. 4.1: Feedback loops of the Coping Development Model

At any particular level of existence, with the requisite structure in place, the loop of problem solving and coping development maintains stability. The outer loop of identifying the dissonance and facilitating the jump results in a shift up the levels of existence. This is balanced via new existential problems occuring which are explored by the planning phase.

It should be noted that the current active level of existence influences the environment which in turn influences the existential problems.

Throughout the application of the model, it is important to always seek out the fundemental solution to any issues that arise.

Considering Senge's shifting the burden, (33) "A Short-term solution" is used to correct a problem, with seemingly positive, immediate results. As this correction is used more, fundamental long term corrective measures are used less. Over time, the capabilities for the fundemental solution may atrophy or become disabled leading to even greater reliance on the symptomatic solution. The feedback loops are shown in Fig. 4.2.

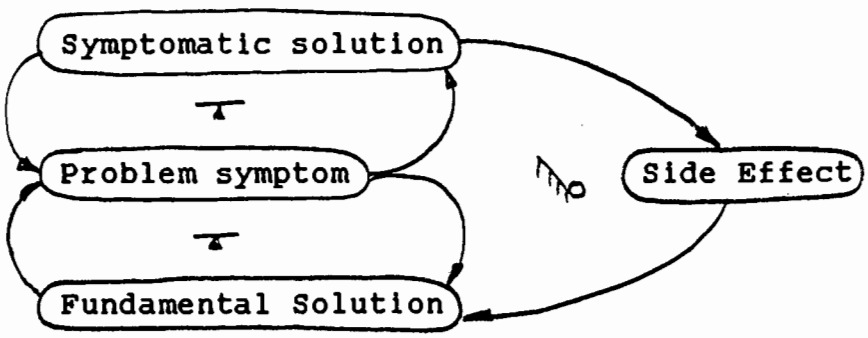


Fig. 4.2: Shifting the Burden

The risk with applying symptomatic solutions instead of the often more complex and slower acting fundamental solutions can be substantial. The self sustaining action of the model can be broken down without realising that it is happening. This may ultimately result in a loss of credibility in the model, dissonance and reversion to lower levels of existence.

In addition, it is important to solve the problem at the lowest possible level. Intervention by higher level members results in an eroding and possible collapse of the self sustaining nature of

the model.

There is a very real risk in the pressures of production that symptomatic solutions will be used for expediency. Symptomatic solutions do not enhance the learning experience and must be avoided.

Senge (33) has a special systems archetype for the situation - Fig. 4.3.

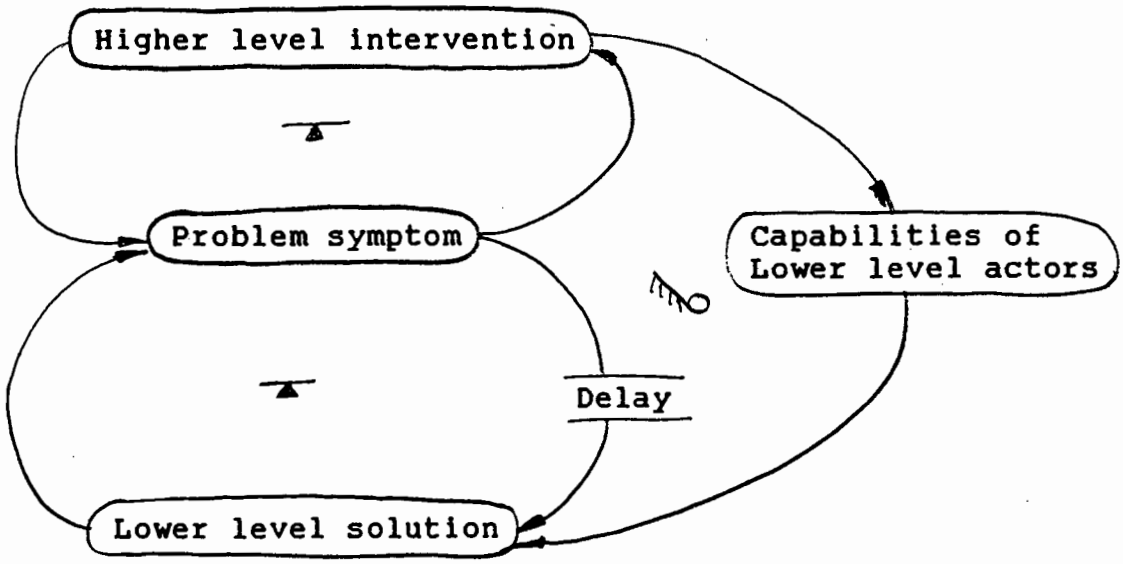


Fig. 4.3: Shifting the Burden to the Intervenor

"Teach people to fish rather than giving them fish".

The following sections will discuss the various stages of the model in more detail.

4.2 Planning

Before selecting a planning methodology it is worth considering the options.

Ackoff contrasts four types of planning (40); reactive, inactive, preactive and interactive.

4.2.1 Reactive Planning deals with solving problems in a piecemeal fashion with the objective of returning to a previously acceptable state. It can be associated with the mindless, mechanistic organisational model seeking a present similar to a past.

4.2.2 Inactive Planning attempts to maintain a present state of affairs without expecting or desiring change. The organisation would be operating mechanisically but satisfied with its current situation.

4.2.3 Preactive Planning is concerned with the future and believes that change is necessary to adapt to the future. Forecasting techniques are used to try to predict what the future holds and then change the organisation to fit the future. The organisation would be operating as an organistic model with the "head" trying to predict the future and guiding the rest of the "body" towards the future.

4.2.4 Interactive Planning does not attempt to return to the past, or to maintain a present state, or to adapt to a predicted future, but rather considers the past, present and possible future and tries to influence the future. That is, the future is

influenced by an organisation and the organisation must therefore invent ways of seeking the ideal. The intention is to "dissolve" problems in a fundamental way and not "solve" them symptomatically. Interactive planning involves all members of the organisation.

The purpose of the Coping Development model is to facilitate an organisation's evolution into a Social Systems, World Class Manufacturer. To achieve this, a planning methodology which considers the past, present and future is envisaged. In addition, interactive planning attempts to fundementally solve problems rather than symptomatically treat them. This is important if an organisation is to develop and not constantly solve the same problems. Interactive planning addresses both of these issues and is therefore considered to be the best planning methodology for the Coping Development Model.

There are a number of principles of Interactive Planning to be considered:

Participation:

The planning process itself is more important than the final plan. As stated earlier the means contribute more to an organisation's development than the ends. If the organisation is to learn through the planning process, all members of the organisation including external stakeholders need to contribute to the exercise. Planning boards are set up at each level of the

organisation. Clearly the structure of the organisation is important, the planning board must include people who are operating at similar levels of existence if they are to communicate. In summary, the planning process is not limited to a small number of senior managers but must include all stakeholders.

Continuity

By definition, interactive planning helps to shape the future. The planning must therefore be a process and carried out iteratively. This is taken into account in the coping development model.

Holistic Approach

The various levels of the organisation must plan simultaneously and interdependantly. Clearly any plans carried out at one level influence the planning at other levels.

The above principles must be considered when applying the interactive planning methodology.

Interactive Planning Methodology

To provide a flow to the planning, Ackoff has divided it up into five phases (51).

Formulating the Mess - where are we?

Ends Planning - idealised design, where do we want to be?

Means Planning - how to get there

Resource Planning - what do we need?

Implementation - let's do it!

* Formulating the Mess

The objective is to formulate the situation that the organisation is currently in. The "problems", threats, opportunities and prospects need to be considered. The assumption is made that the organisation would continue as it is and that the environment would behave in a predictable fashion.

A systems analysis must be carried out to draw up a rich picture of the organisation, how it works and what the internal and external relationships are.

Any obstacles to organisational development need to be highlighted.

The organisation's present performance needs to be extrapolated into the future.

The synthesis of the systems analysis, the obstruction analysis and the extrapolation provides a reference scenario regarding the organisation's current situation.

* Ends Planning

The "ideal" end needs to be described. This idealised design must include the ideal from all the relevant stakeholders perspectives. That is, if the stakeholders could replace the existing system today, what would it look like?

It should be realised that in the South African context, the view of the "ideal" may be quite different for workers and management. This must nevertheless be explored and discussed. Only through showing different points of view can common ground be found.

A mission statement regarding the purpose of the organisation and its responsibilities to its stakeholders and the environment needs to be clearly defined. This helps in providing a shared vision of the idealised design. The desired properties and how these properties can be obtained and maintained must be included. Constraints of technological feasibility and operational viability must be applied. Financial, political or other constraints must not be applied. The ability of an organisation to influence its future cannot be constrained in the ideal seeking process.

* Means Planning

The gap between the "ideal" and the formulated mess is evaluated and a brainstorming method used to consider and vet ways of closing the gap.

* Resource Planning

The resources required to achieve the means are considered. This includes human resources, capital equipment, technology etc.

* Design of Implementation and Control

This phase is intended to keep the planning process on track and to ensure that the best person for the task is actioned. Deadlines are set and feedback used to maintain implementation rate.

More detailed information on interactive planning and application case studies are presented in Ackoff's book "Creating the Corporate Future" (36) and Garajedaghi's "Guide to Controlling your Corporation's Future" (40).

These texts provide a detailed description on the Interactive Planning methodology used in the planning stage of the coping development model and are therefore worth studying in more detail.

After the planning phase a restructuring of the organisation must be considered. This may be necessary if the "ideal" organisation is to be approached. Structure is discussed further in the next chapter.

4.3 Structure

Throughout the application of the model, development of the individual and hence the organisation is the primary consideration.

Garajedaghi defines development as:

"The development of a social system increases its ability and desire to serve its members and its environment by constant pursuit of: truth, plenty, good, beauty and liberty. It results in a purposeful transformation towards increased integration and differentiation at the same time". (41)

The "ability" is directly related to the particular level of coping development at which the organisation exists. In addition, "desire" is related to the quantum leaps discussed in Grave's level of existence ladder (37).

Development is about learning to use the resources and options available to the organisation more effectively and efficiently. Only with experience of choice can the organisation learn to cope and develop.

Garajedaghi defines the state of a social system as:

State = f(S,F,P,E)

Where: S = Structure: Components and the irrelationships

F = Function: Output produced

P = Process: Rules of transformation

E = Environment: Uncontrolled variables

The customer's needs and environmental conditions have been considered via the Interactive Planning process and should be well understood before considering the organisational structure.

The structure of a system defines the relationships that form the "glue" of an organisation. This bonding is shared information and knowledge. In addition, for stability to occur, the relationships need to function harmoniously and purposefully.

Clearly structure is critical to any successful organisational change and development.

There are four major considerations to structural design:

* Ability to produce the correct output effectively and efficiently

* Hierachically based dependant upon the levels of existence of its members. That is, within each structural level of the organisation, the employees need to be operating at a similar level of existence.

* Mentorship from higher levels down to the lowest level

* Interrelations between the various parts

These aspects must all be combined to design the best structure for a particular time in the coping development of an organisation

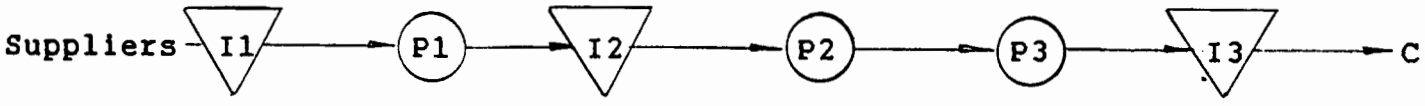
4.3.1 Output - The process flow organogram

In a manufacturing organisation where raw materials are converted into a product by adding value, a process is involved. An organisation's structure either accelerates or inhibits the ability to achieve a corporation's goals and symptoms of failure to perform indicate a structural weakness (42). It is important therefore to design a structure around the process that will provide the customer with the product.

Before considering the structure, the process requires investigation and defining.

A convenient way of doing this is to split the process up into inventory holding points and transformation cells.

A typical manufacturing process is shown in Fig. 4.4 using this format.



Where:

I1 = Raw material store

P1 = Initial process

I2 = Subassembly store

P2 = Assembly

P3 = Finishing

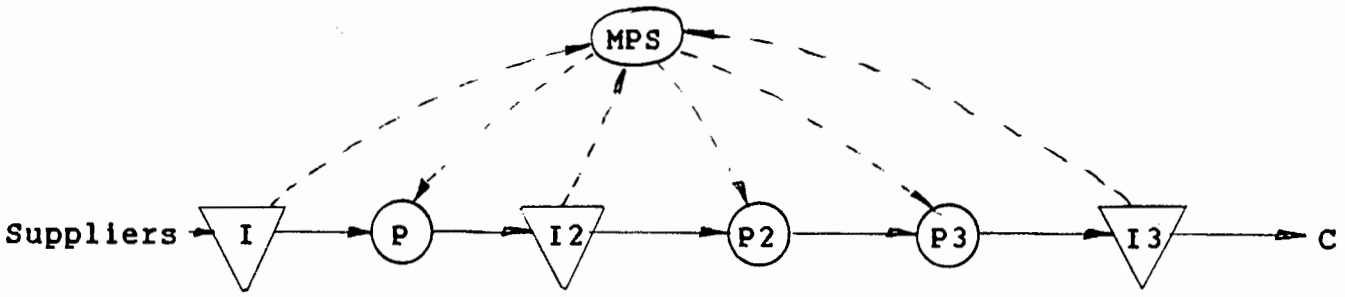
I3 = Finished goods store

C = Customer

Fig. 4.4: A Manufacturing Process Flow

The process must initially be considered on a macro scale with the emphasis on the value adding transformation. In other words, the process cells must be based upon a significant transformation of the previous "product" in terms of value and possibly appearance. If any significant holding areas with re-order points occur before or after the process cells, these must be defined as Inventory points.

A planning or scheduling function normally exists and must be included. It is recommended that the planning or master production scheduling is associated very closely to the last process and inventory holding point as shown in Fig. 4.5.



Where: MPS = Master production scheduling

All dotted lines are information flows

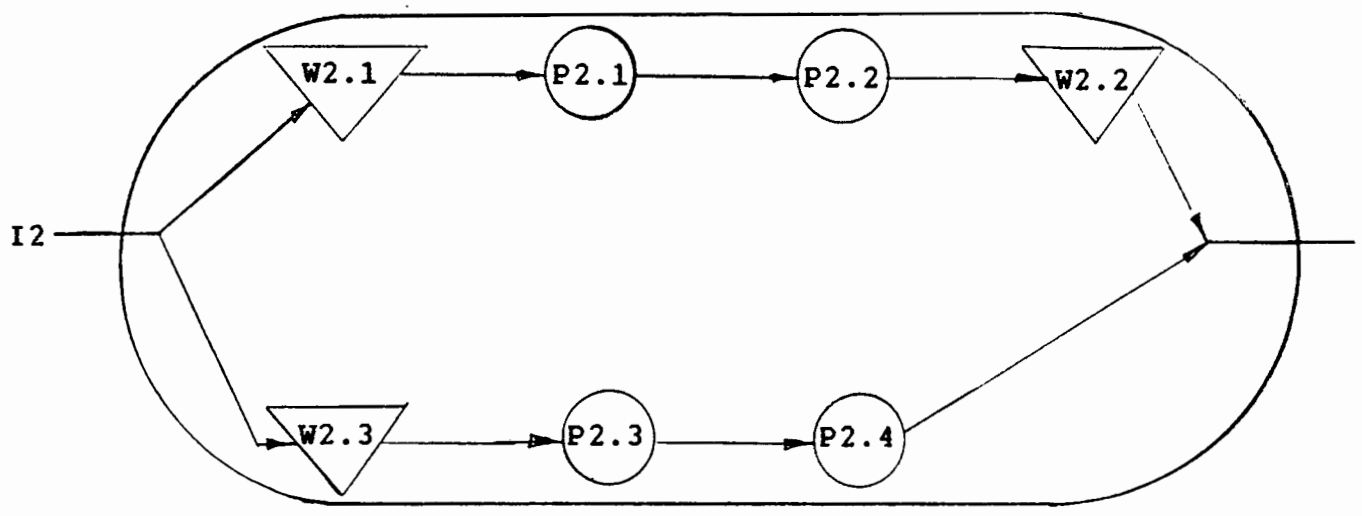
All solid lines are material flow

Fig. 4.5: Process Flow with Planning

Re-Order information is generated at each inventory point and sent to MPS where process demand decisions are made and resources allocated.

MPS must have the authority and responsibility for the final production process and Inventory to ensure customer promise ownership and a pull instead of a push process. If the process is complicated with many stages, a process flow facilitating function may be useful as part of MPS.

Each of the process cells may be broken down further into minor processes and work in progress holding points is shown below in Fig. 4.6.



Where: W2.i = work in progress area i in Process Cell 2

P2.i = sub-process cell i in Process Cell 2

Fig. 4.6: A Manufacturing Cell

Once the process has been fully described using the methods discussed, a structure can be designed to ensure that a cell leader takes ownership of the process. This must include all cells, subcells, inventory points and work in progress areas. Clearly there are advantages in physically laying out a factory along similar lines. This however will not be discussed further. At the time of designing the structure, the individuals concerned in running the process must not be considered, only the function is of importance. The objective is to design the ideal process flow structure to provide the correct output. Compromises will be discussed later.

A hierachical approach must be used to draw up the resulting process flow organogram. It is important for the people operating within the structure to clearly understand their role to prevent abmiguity and overlapping of responsibility and authority. In addition, effective co-ordination and integrated control can only be achieved in a hierarchically based structure (43). Whilst a hierarchical structure may appear mechanistic, and hence not consistent with the evolutionary process, it should be noted that the structure would be evaluated and changed if necessary during each iteration of the Coping Development Model. As the organisation becomes a WCM, it may find that other less rigid forms of structure are more pertinent.

A typical organogram for a simple three cell process is shown in Fig. 4.7.

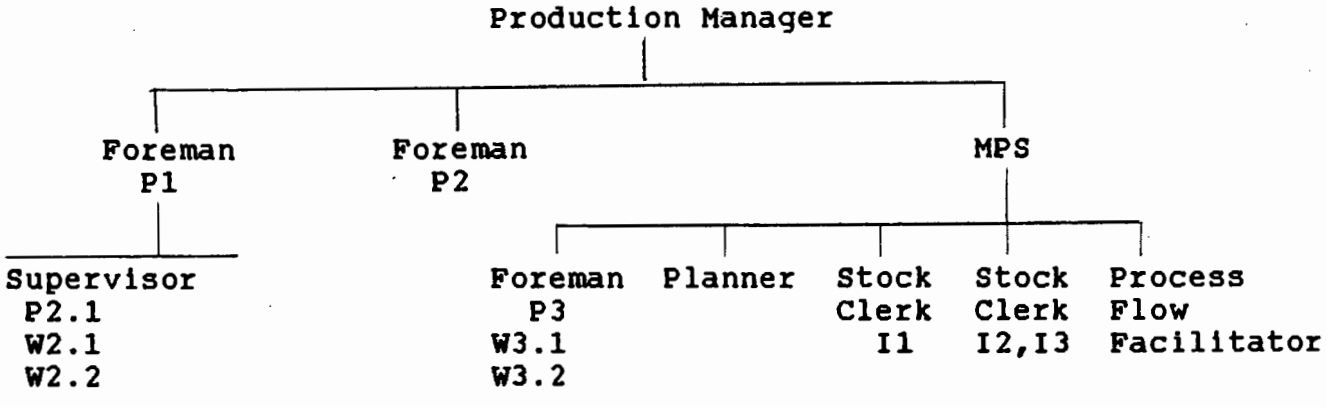


Fig. 4.7: A Hierachical structure

The structure should be built around each of the major process cells. Each cell should have a manager or supervisor and report into the more senior total process manager.

A similar method can be used for constructing the ideal structure for all sections of the business by considering them as processes with inputs, outputs and transformations. The investigative process itself is a useful exercise and results in a deeper insight into the operation of the business.

Once the appropriate process structure has been developed, it is necessary to place individuals in the respective position. This usually involves compromise in terms of the skill levels and the characters involved. The following points must be kept in mind when making the choices regarding placing of people and compromises.

4.4 Levels of Existence

Graves states clearly in his paper "Human Nature prepares for a Monumentus Leap" (37) that people coping at a lower level of existence cannot communicate with (or understand) people coping at a higher level of existence, the converse may also be true. It can be difficult for somebody who is in a well paid, senior position in an organisation to appreciate how difficult it is to survive at a lower level of existence and how the energy required for survival prevents a person from coping with higher level

product quality issues etc.

It is therefore important to try to place people coping with similar levels of existence in similar levels in the process organogram. It may be useful to consider how mechanistic their current job is and how well they cope with choices. This should be combined with Fig. 2.16 to try to identify their current levels of existence. Detailed personnel performance records should be kept to help in the iterative restructuring process.

This approach will help people communicate horizontally across the structure within the same level. In addition, the vertical communication between levels will be improved due to communication only having to occur across one level at a time.

4.4.1 Mentorship

The author would argue that in many organisations there is too much management and not enough "mentorment". It is important for the team leader (or manager) of each group of people in cells or subcells to train, guide and encourage his team members to cope with their existential problems, particularly work related issues. This will result in people learning to cope with their situations more effectively and hence become ready to move up to a higher level of existence. Senge argues that leaders are teachers (51) and are capable of "helping people achieve more accurate, more insightful and more empowering views of reality".

The author agrees with this but prefers the term "shared

reality". That is, a leader is capable of painting a rich picture of his view of reality including many broad aspects of the organisation's situation. This picture should be shared with his subordinates to provide them with both the reasons why and how things should be tackled. This provides a sense of purpose to his subordinates.

When placing people in leadership roles, their technical skills, management skills and "mentorment" skills must all be considered. The importance of being a mentor must be openly explained to the team leaders and they in turn must practice being a mentor to their own team.

"Mentorment" includes:

* providing the correct environment for self motivation

* teaching through discussion about options (dialectic discussions)

* delegation of the correct work to the person best able to just cope with the job, thereby developing coping skills

* identify the rate at which various people learn to cope and adjusting their work complexity accordingly

* helping with external problems whenever possible. It is important that external issues do not impinge on the coping development process

The attitude of team leaders must be one of positive feedback and re-inforcement.

4.4.2 Interrelations

Within any structure there is a risk that unspoken rules will take priority over spoken rules (42). It is therefore important to clearly define company policies, procedures and communication channels. It is suggested that the description of the ideal structure is used to check communication between each of the organisation's major functions (sales, production etc.) In addition, the communication lines within process cells must be defined. Communication must be as simple as possible, unambiguous and timeous. This can only be achieved in a well explained and understood structure with an environment of openess and willingness to learn.

4.5 Employee Learning

Before discussing learning through problem solving, it is important to realise that problems can be treated in different ways. Problems can be resolved, solved or dissolved (43).

Resolving Problems

When a problem is resolved, an outcome which is "good enough" is formulated. The solution is suboptimum and usually addresses the

symptoms. The solution is "discovered" using "gut feel" and past experience. There is no learning during the problem resolving experience, only a re-inforcement of previously learned, subjective solutions. Managers usually carry out the problem resolving and do not allow lower level people to suggest alternatives. It results in survival but not growth.

Solving Problems

Problems are solved when an optimum solution to a problem is found. This is usually carried out by using scientific methods of research and experimentation. That is, observation and measurement. A "best possible" solution is found. The scientific manager embarking on problem solving would typically use lower level employees in the gathering of information for expert investigations. There is some learning during the problem solving process and the organisation can grow through the experience.

Problem Dissolving

A problem is dissolved by changing the environment or the nature of the entity that has the problem. This removes the problem and prevents a re-occurance of the same problem. It is an idealizing process that brings the system closer to the desired state - both "gut feel" and research methods are used to remove problems. The subtlety is in changing the characteristics of the system that caused the problem. This can only be achieved by involving all

stakeholders in the change process. Problem dissolving results in development of the organisation and its people.

The change model that has been prepared is one of coping development. The intention therefore is learning through problem dissolving.

It is also important to realise that treatment of a problem often results in other problems appearing elsewhere in the organisation due to the changes required by the first problem removal. The problem dissolving process is therefore a continuous learning and developing experience.

To enable problems to become evident, standards are required. Products and process may be compared to the accepted standards and gaps between what is required and what exists will then become clear. These gaps may then be addressed with problem solving. Systems engineering is used to set the standards and specifications.

4.5.1 Systems Engineering

From the Interactive Planning process carried out in a previous phase of the coping development model, an idealised design of the organisation exists. This however is not that easy to apply on a daily basis, it is more useful for general direction. A more pragmatic although somewhat mechanical approach can be used effectively for testing conformance to requirements. This

involves setting up an idealised operating manual along similar lines to the ISO 9000/SABS0157 and continuously testing actual performance against the manual. Performance variances may then be addressed using action learning and systems intervention. It is important to realise that the operations manual is not absolute and requires reviewing during interactive planning. It must be a working document flowing from the planning process. In addition, it must not reflect the current state of the organisation but where the organisation would like to be at the beginning of the next interactive planning phase, typically one year into the future.

The manual should include the following sections:

* Mission Statement

The mission statement should identify the business that the organisation wants to be in and the effects of that business on its stakeholders. It should be challenging and exciting and serve to unify and focus the organisation on its purpose.

* Structure

The structure, as developed in the previous phase of the model, must be included. In addition, Position Charters clarifying the relationships between the various levels of the organisation are useful. These documents define; levels of responsibility and authority, broad categories of work and specific requirements

needed for the organisation to be effective and efficient. A typical position charter is appended (Appendix 4). Detailed records of all employees must be kept. This is to include appraisals, completed training programmes and possible future programmes.

* Process Flow Charts

Details of work instructions and inventory policies must be added to the process flow charts developed earlier. Product sub-assembly and raw material specifications must be included.

* Process Conformance

From the process flow charts, work instructions and specifications, process control charts can be compiled. These must include:

- raw material receiving and testing
- in process inspection and testing
- final inspection and testing
- maintenance of test records, equipment and testing authority
- control of non conforming product
- suggested corrective action
- handling storage, packing and delivery.

A manufacturing control chart from the South African Bureau of Standards has been included (Appendix 5). These control charts show how the various aspects of product/process conformance can be summarised into a useful working document to test the actual process compared to the ideal design process.

From the testing of the actual process compared to the ideal, problems will arise which will require investigation and removal.

The removal of problems must be a learning and developmental experience for the individuals concerned. Action learning fulfills these requirements.

4.5.2 Action Learning

The objective of this stage of the model is to develop people's coping ability by tackling problems on a project by project basis. In addition, by dissolving problems permanently in the workplace, the organisation moves one step closer to becoming a world class company.

The development of an individual's coping ability requires successful completion of challenging tasks which positively re-inforce the person's confidence. This raises the level of expectation and hence ability.

Action learning or learning by doing is a process which specifically addresses this technique of problem solving and learning. The concept is well summarised by Garrat (44).

"Action learning is a process for the reform of organisations and the liberation of human vision within organisations. The process is based on taking one or more crucial organisational problems and, in real time, analysing their dynamics, implementing proposed solutions derived from constructive critisisms of collegues, monitoring results; and through being held responsible for these actions, learning from the results so that future problem solving and opportunity taking is improved. The whole is underpinned by the proven assumptions that people learn most effectively with and from collegues in the same position".

The action learning cycle is shown in Fig. 4.8 (45). The key elements of this process warrant further discussion.

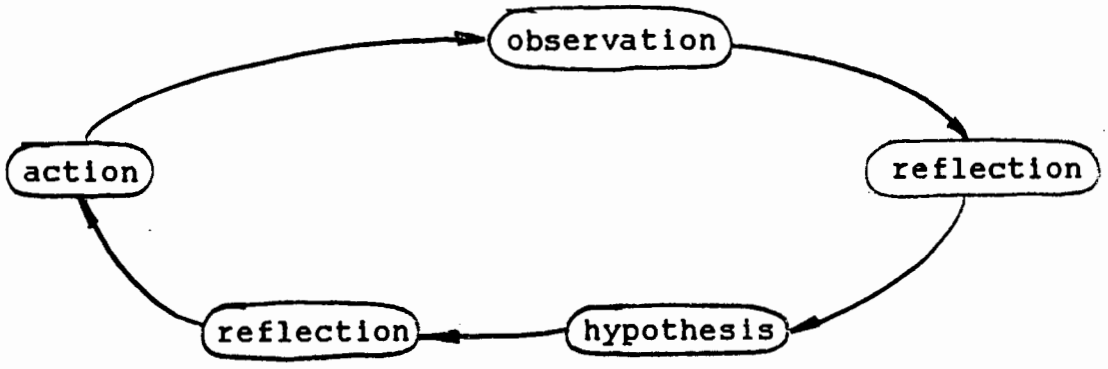


Fig. 4.8: The Action Learning Cycle

4.5.3 Key Elements of Action Learning

* Action cells must be made up of people living at similar levels of existence

* the action cell must be led and facilitated by a mentor operating at one level higher in the levels of existence hierachy

* the mentor's values will eventually influence the cell and result in an overall uplifting of values (46)

* important problems which directly effect the organisation must be chosen

* the action cell must have the authority to take the action it recommends

* the organisation must be willing to take the risk of allowing the action cell to take its own risks

* the problems must be real and difficult to solve. They must not be easily resolved by a technical expert

* responsibility for dissolving problems must be given to cells that own the problem

* the rate of learning must be greater than the rate of change

* the mentor must facilitate free thinking and discussion to use the group synergy effectively

* the cell must be encouraged to question work practices and techniques to expose problems

* regular cell meetings are essential

* the project that is selected must require coping skills at one level higher than the cell members are currently operating. This extends the work skills and coping mechanisms

* the cell members must be encouraged to see multiple perspectives regarding possible problem solutions and people's opinions. Growth and development cannot occur without option selection through dialectic discussion.

The action cell process is similar to quality circles, green areas etc often used in quality improvement process. There is however, a difference in emphasis. Action learning stresses people development through learning rather than solving problems.

The Coping Development Model uses action learning as a means of learning through solving daily problems. This however may not be effective for managers trying to get more insight into the strategic running of the organisation. This second aspect of "problem" solving will be discussed in the next section under the heading of Management Learning.

4.6 Management Learning

An organisation is faced with problems of varying levels of complexity. For the organisation to develop as it learns to solve these problems, they must be actioned at as low a level as possible while still stretching the coping abilities of the respective employees. Solving problems at a higher level will prevent lower level employees from developing through the problem solving experience. Some problem situations however are so complex and messy that action learning will not be effective. This is because the problem situation is not understood in the first place. The intention therefore is to use Total Systems Intervention to explore these messy situations and discover ways of seeing the woods and the trees. The problem situation is then revealed more fully and changes can be considered to fundementally help the situation.

As the understanding of the complexity of Human Activity Systems developed over the past few decades, various methodologies have been proposed for intervening in these systems. They are well described in Flood's book "Creative problem solving, Total Systems Intervention" (39). For completeness, it is however worth presenting a summary of the more significant methodologies.

The methodologies to be discussed are:

* systems dynamics (SD)
* viable system diagnostics (VSD)
* strategic assumption surfacing and testing (SAST)

* soft systems methodology (SSM)

* Critical systems heuristics (CSM)

It is however important to consider the methodologies in terms of the complexity of the problem situation. A matrix has been compiled to help in the selection of the best approach for the perceived problem complexity. The above methodologies are printed in bold type on the matrix Fig. 4.9.

	Unitary Relationship	Pluralist relationships	Coercive relationships
Few System Elements Few element interactions Element attributes understood Organised interactions Behaviour governed by laws System does not evolve Sub systems do not pursue their own goals Systems unaffected by behavioural influences System closed to the environment	Share common interests Values and beliefs compatible Agreement on ends and means Act in accordance with agreed objectives	Basic compatibility of interest Values and beliefs diverge to some extent Ends and means compromise possible Participation in decision making Act in accordance with agreed objectives	Do not share commitments Values & beliefs conflict Genuine compromise impossible Some coerce others to accept decisions No agreement over objectives is possible
	Operations research Systems analysis Systems engineering Systems Dynamics	Social systems design Strategic assumptions surfacing & testing	Critical systems Heuristics
Many system elements Many element interactions Loosely organised interactions Behaviour probolistic Systems evolve over time Sub systems pursue their own goals Systems affected by behavioural influences System open to the environment	Viable systems diagnosis General systems theory Socio-technical systems Contingency theory	Interactive Planning Soft systems methodology	No tools available yet but consider: organisation's sources of power culture & changes hierarchical relationships regarding ethnic groups etc

Increasing Complexity

Mechanistic — Organistic — Social

Mindless — Unimminded — Multiminded

Fig. 4.9: A Matrix of System Methodologies related to situation complexity(52)

Clearly any messy situation is not easily fitted into the boxes of the matrix. Indeed the matrix is more a continuum of complexity. The intention is to provide some direction where to start and thereby guide the reader to more in depth study of the methodologies and intervention in the problem situation.

4.6.1 Systems Dynamics (SD)

Systems dynamics considers a complex situation as a series of simple elements and interconnecting links. These elements and links are defined by the structure and relationship of an organisation. It is assumed that behaviour is characterised primarily by structure and the behaviour of a complex situation may therefore be more fully understood by modelling the cause and effect feedback loops of a situation. SD may be taken a step further by mathematically defining the relationship between elements and running the SD model on a computer. Software packages such as DYNAMO are available for this purpsoe. It can be used effectively to help understand the dynamics of inventory fluctuations, customer demand cycles, labour absenteeism, that is where the inputs and the outputs are quite well understood but the cause and effect is unclear.

Some principles of Systems Dynamics

* Understanding the behaviour of feedback systems is the goal
* A feedback loop is a closed sequence of cause and effect. They may be negative (goal seeking controlling) or positive (growth producing)
* The number of levels (order) used to represent the structure is of primary importance
* Non linearity can occur by interconnecting positive and negative feedback loops

* Computer analysis is usually required if more than a few loops are involved. The intention remains however an insight into reality not to precisely model reality.

* Relationships are called rates and are flows which change over time

* Primary elements are called levels and change over time

The iterative stages of SD modelling are shown in Fig. 4.10

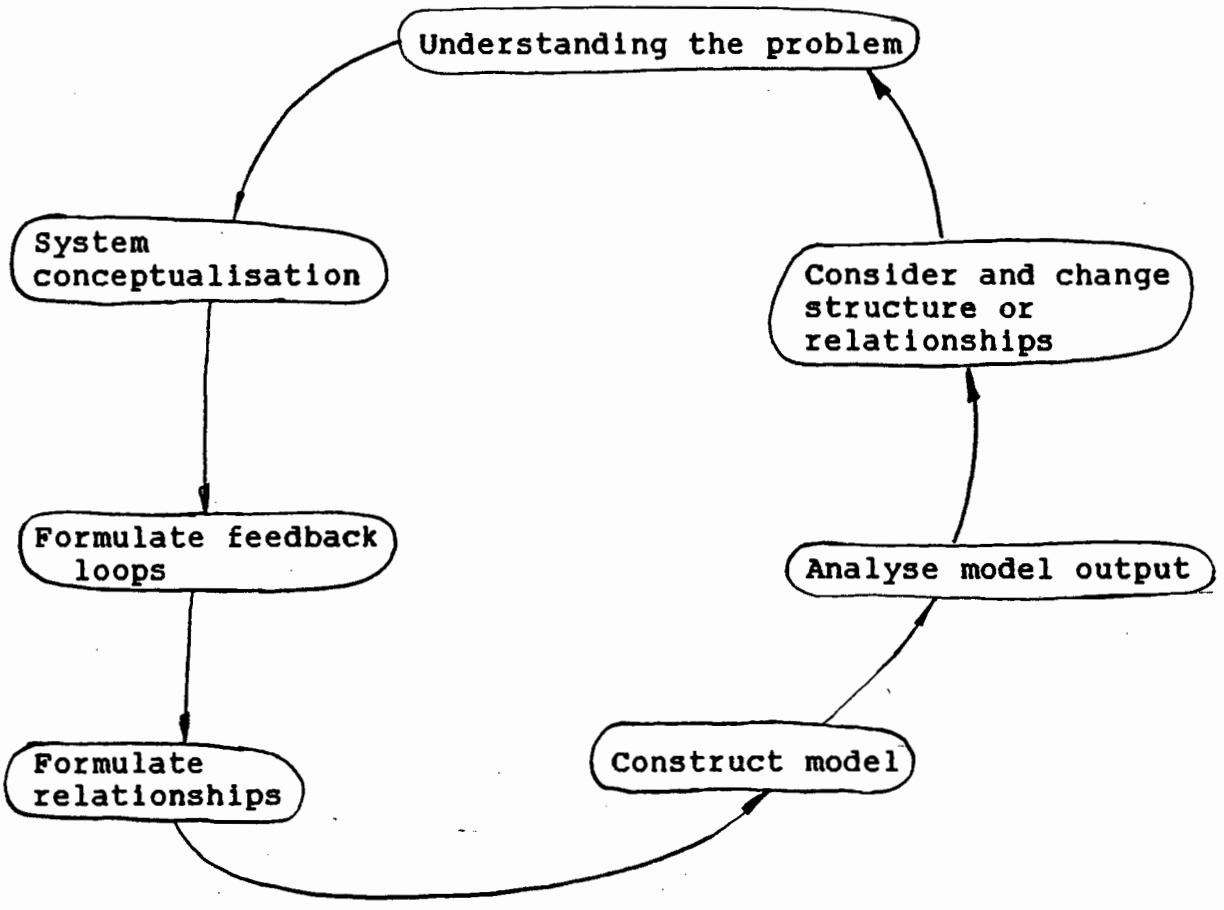


Fig. 4.10 The Stages of SD Modelling

4.6.2 Viable System Diagnosis (VSD)

Stafford Beer's viable system model is a cybernetic view of an organisation. That is, an organisation is seen as a control system similar to the neurocybernetic processes of the human brain. It is a modelling technique for comparing an organisation with the cybernetically viable system. This improves the understanding of some organisational weaknesses resulting in defective output.

In terms of the coping development model, VSD is useful in examining organisational structures to ensure that the necessary control systems exist and in fact are possible from the highest level to the lowest level.

Principles of VSD

* Specific structures are not recommended, the emphasis is on control and local problem management.
* Recursion or vertical system replication is fundemental to each subsystem maintaining control
* At any sub-system level, guidance is provided by the higher levels
* The relationship between each viable unit and its environment and how the relationships influence organisation learning is emphasised.

By testing an organisation against the viable system model, control deficiencies become apparent.

4.6.3 Strategic Assumption Surfacing and Testing (SAST)

In any system, the entities comprising that system are only evident through their relationships with other entities. These relationships are therefore of primary importance in any organisational diagnostics. SAST is a technique for focusing managements attention on relationships between participants involved in a problem situation. SAST is particularly useful when strategic differences of opinion are preventing effective action being taken. It attempts to bring conflicts to the surface and to manage them thereby bringing about a synthesis of beliefs (58).

Principles of SAST

* Most strategic problems in organisations are complex and messy and not well suited to traditional and management science problem solving techniques.

* For an organisation to really begin to learn, its most fundemental assumptions must be challenged.

* All opposing perspectives must be considered

* Different levels within the organisation must be included to

more richly consider the alternatives.

* The various alternatives must eventually be synthesised to enable an action plan to be formed.

The SAST methodology is shown in Fig. 4.11.

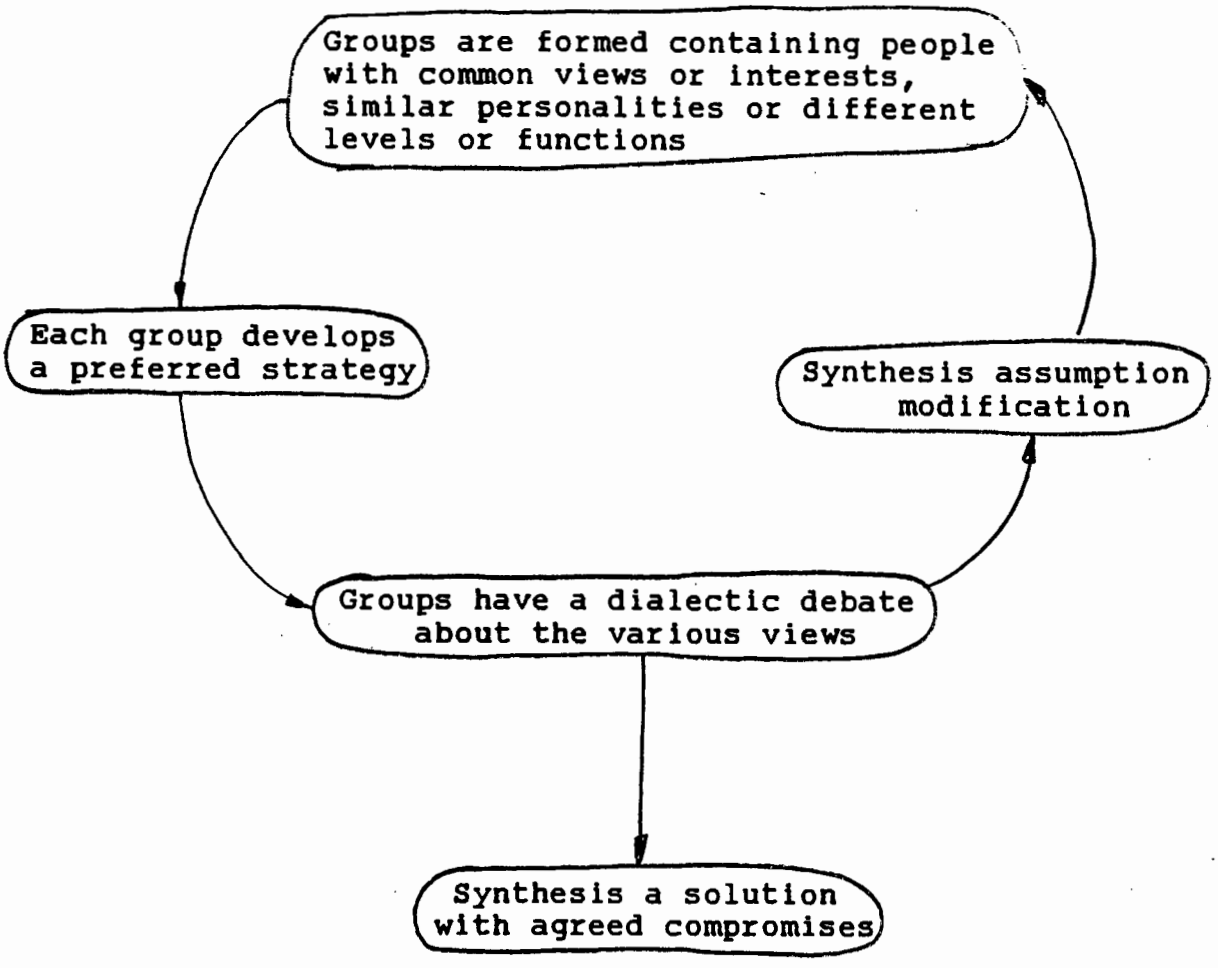


Fig. 4.11 The SAST Methodology

In some organisations SAST is carried out almost unwittingly as part of management practise. It is however useful to formally carry out an SAST exercise when the coping development model is losing direction due to conflicting management thinking.

4.6.4 Soft System Methodology (SSM)

Soft system methodology has developed to address problem situations where the problem is not clearly visible, but an acceptable system response is occuring with compatibility of interests (59). It specifically focuses attention on exploring the mess and applying "solutions" to assumed problems. The methodology organises various people's views about problem situations in a "hard" or logical way.

Principles of SSM

* SSM is a process of enquiry leading to purposeful action. It is an iterative, learning process.

* The methodology accepts that "problems" today may not be "problems" tomorrow. In addition, as a solution is approached the problem may shift.

* A wide variety of perceptions must be considered to fully describe a situation

* The intention is to develop models depicting a situation for discussion and problem solving (60).

Soft System Methodology

The SSM has seven stages of enquiry. These are best understood by considering Fig. 4.12 (46).

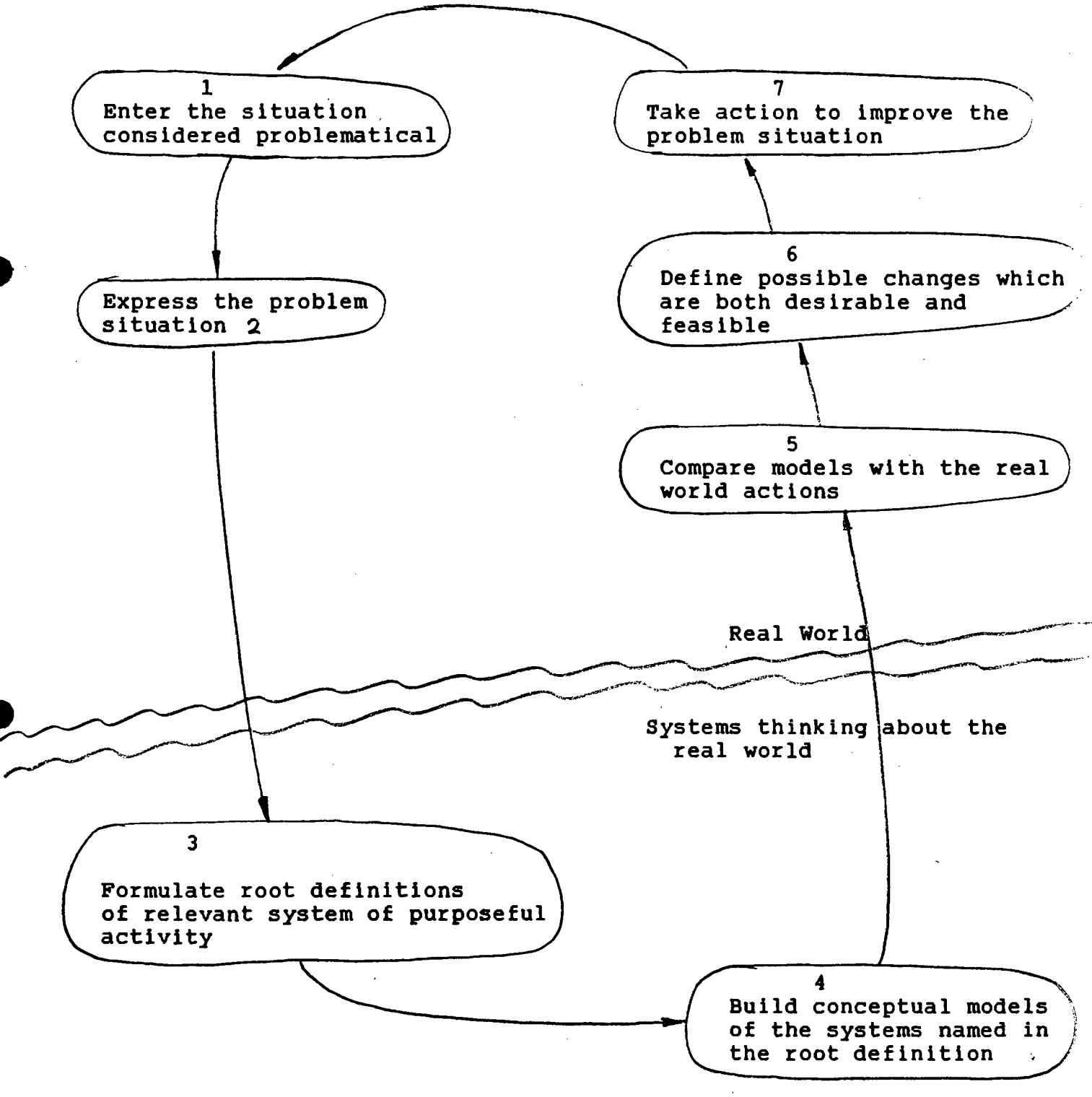


Fig. 4.12 The Soft Systems Methodology

Stages 1 & 2 are best carried out by observation and informal interviews to result in a rich cartoon like picture of the situation.

Stage 3 is concerned with formulating the situation verbally. A root definition of the various systems and sub-systems must be drawn up with the following considerations:

Customers - who would be the victims or beneficiaries of the purposeful activity?

Actors - those who do the activities

Transformation process - the activity that transforms input into output

Weltanschauing - what view of the world makes the definition meaningful

Owner - who can stop the activity?

Environmental constraints - the environmental constraints the system takes as given

The conceptual models are constructed around the root definition in Stage 4. Typical root definitions and models for SSM are appended (Appendix 3).

Reality may then be compared to the model in Stage 5 and changes defined and actioned in Stages 6 & 7 respectively.

SSM is best applied when management is seeking to apply organised action to a changing, interacting mess of ideas and events (61).

4.6.5 Critical Systems Heuristics (CSH)

Critical systems heuristics is a technique to help reveal the true motivation underlying proposals. It is therefore useful in politicised or coercive situations where powerful managers can impose their will on others and there is a lack of agreement of goals (62). All proposals are subjected to a critical appraisal resulting in a more transparent system proposal.

Principals of CSH

* Any system must have a purpose. In addition, in a purposeful system, the ability to determine the purpose must be spread throughout the system. For this to occur, the system must generate and disseminate information about its purpose for a dialectic debate.

* System designs must be critically examined with respect to social system design.

* The values and moral imperfections must be critically examined with particular emphasis on the players that are affected by the system but not involved in the design.

* The system designer must build in checks and balances which will attempt to guarantee that the planning will lead to an improved situation.

CSH Methodology

The first part of CSH helps planners critically evaluate their own designs. The second part encourages rational debate between other stakeholders and the planners regarding the partiality of the plans. The former is examined by asking 12 questions regarding the boundaries, judgements and constraints applied to the plans. The questions are asked twice, firstly, "what is...?" and secondly, "what ought...?" This then leads to the rational debate between the planners and the affected but not involved people. During this debate the non planners have full authority and in fact are encouraged to challenge the planner's boundary judgements with their own personal values. Proof of superiority of judgements is not required. This has the effect of shifting the burden of proof to the planners.

The twelve "is" and "ought" questions are appended (Appendix 4).

The system intervention methodologies should be used by senior management when the coping development model appears to be losing direction or efficiency. By considering the perceived situation and the table of methodologies (Fig. 4.9) the most pertinent intervention technique can be selected. By applying the technique, a deeper understanding of the situation will be developed which should lead to renewed energy and commitment to the coping development strategy.

4.7 Moving to a higher level of existence

The final phase of the coping development model is moving individuals and hence the organisation to a higher level of existence through the development of the person's coping ability. Maslow's original hierachy of needs assumed that people would move up the hierachy automatically once the lower level needs had been satisfied. Graves disagrees with this and believes that certain conditions are necessary before this level "jump" will occur.

It is important to realise that at the congruence of existential problems and coping ability the person (or organisation) is in a metastable state. It is possible that if a level shift occurs, it will be to a higher or lower state. The facilitators of the coping development model must be aware of this and provide the correct environment for the shift to a higher level of existence. There are six factors which need to be present before a rise to a higher level of existence can occur (63).

* Potential in the brain
* Resolution of existential problems
* Dissonance
* Insight
* Overcoming barriers
* Consolidation

4.7.1 Potential in the brain

Clearly a shift to a higher level of existence is not possible unless the coping ability has developed to the point where the individual has the inate ability to operate at a higher level.

It is important to be aware of the level at which people are existing to enable the shift to be correctly managed. Characteristics of people at the different levels of existence have been summarised in Fig 2.16. This will help in making assessments regarding the readiness of individuals (and hence the organisation) to change.

4.7.2 Resolution of existential problems

The problems encountered at a particular level of existence must have been resolved to the point where the individual starts asking himself "so what's next?, where do I go from here?, this can't be all there is to life?".

At this stage the individual is ready for a move upwards due to the presence of mental energy which is not being used for coping at the current level.

4.7.3 Dissonance

Even when "free energy" is available for the jump to a higher level, it will not occur without a crisis period. This period

will be apparent as a regressive-progressive state. Values appear to be disorganised and the world seems to be falling apart. There is a general rejection of the values of the current level. It is clearly important to realise that an apparent rebellion may be the preparation for a jump to a higher level of existence.

During this period of dissonance, the individual searches his previously learned coping "library" for a solution to his problems, hence the regressive behaviour. The old values are however found to be lacking as a method of dealing with the new existential problems. The person is becoming aware of the problems of a higher level of existence but has no mechanism for coping with them.

4.7.4 Insight

Based upon the evolution of the brain due to previously experienced problems and the requisite coping mechanisms the individual gets an intellectual "flash" or insight into how to handle the new situation. This is not rationally thought through but occurs instinctively.

4.7.5 Overcoming barriers

The facilitator of the development process must be aware of the previously described four factors leading to an existence shift. They should not intervene but should ensure that the regressive

behaviour is not destructive. However, for the actual shift to occur, the correct environment must be present. The individual's peers, work situation or even family may make it impossible for the shift to occur. It is important therefore that barriers to development are removed at the point of transition. For example, the individual may require promotion to enable him to associate with people at a higher level.

The facilitator must be aware of the workplace and social situation of all employees. He may then advise management regarding any issues which may prevent a positive transition occuring. Ways and means may then be considered to remove these barriers.

4.7.6 Consolidation

Once an individual has moved to a higher level, he must be given responsibility and challenges requisite with his new state. If this does not occur it is likely that he will leave the organisation.

After the evaluation of the current levels of existence the model returns to the planning phase for the next interactive cycle.

A more complete view of the Coping Development Model is shown in Fig. 4.13.

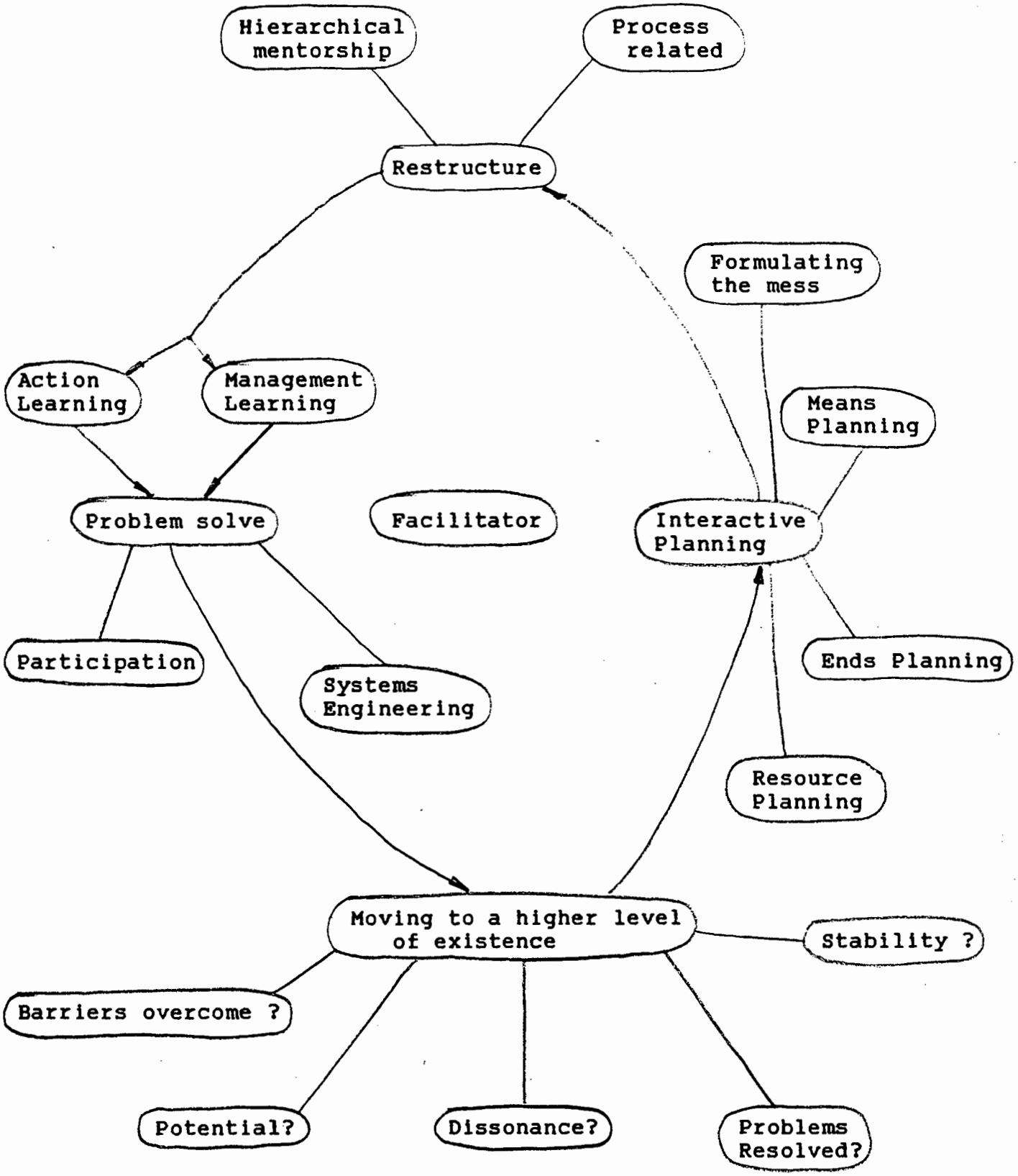


Fig. 4.13: The Coping Development Model

5.0 Question 3 - WHAT COULD GO WRONG? - A Critique of the Coping Development Model

The Coping Development model is a synthesis of a number of well known theories and techniques. It is a model for organisational learning and development leading to world class manufacturing.

Due to the long term and ongoing nature of development, the efficacy of the model in a real world situation is not available at the time of writing. It is however useful to test the efficacy of the model by critical appraisal. This critique will provide further insight into applying the model and hence facilitate implementation.

The critique is divided into four sections; compatibility, methodology, idealogy and utility.

5.1 Compatibility - ability to co-exist

For the model to achieve its purpose, it is necessary for the various aspects of the model to have similar aims and purposes. That is, the organisation should develop along the same path through the application of Interactive Planning, process driven restructuring, Action Learning and climbing up the ladder of levels of existence. In addition, the relationship between these aspects must be compatible to ensure that the model will be stable in the long term.

Gharajedaghi considers interactive planning as the "design of a desirable future and the selection or invention of ways of bringing it about as closely as possible" (53).

The emphasis here is on the design of the desirable future. The Coping Development Model (CDM) uses Ackoff's interactive planning primarily to formulate the messy situation that the organisation is in and to design a shared, ideal situation.

A central feature of interactive planning is planning boards at all levels of the organisation. In the South African context this may be difficult to apply because of a lack of trust between the workers and management due to years of Apartheid. The world views of the two parties are far apart due to this forced separation. Any attempt to sit around the table and discuss what constitutes an ideal picture of the organisation could be frustrating and possibly ineffective.

For the interactive planning process to be effective, managers must interact with workers and realise that their own views of reality are not necessarily correct. They must be prepared to listen to and seriously consider the worker's points of view and aspirations. Only then will the planning boards succeed in producing the rich picture required in an idealised design. Through the planning process, understanding and mutual trust can be enhanced, however the risk of a breakdown remains. A

facilitator has been included in the CDM to help prevent this breakdown. This facilitator must of necessity have credibility with both workers and management, not an easy appointment. It is possible that the world views of the various players are so far apart that a facilitator would not be successful in drawing them together.

The restructuring flows from the planning phase and is therefore consistent with the requirements of design of the organisation. In addition, the CDM uses a structure which is compatible with the production process.

Although the restructuring appears compatible with planning, and indeed is designed by the planning boards, it can be painful. Personnel related decisions may have to be made and they need to be carried out with sensitivity. A "Win Win" situation must be explored where the individuals concerned buy in to the changes. Considerable selling skills will be required by the restructuring facilitator and management.

During the consolidation period after restructuring, problems will become apparent. These problems may be relatively simple and be dissolved by action learning, or more complex and explored by Systems Intervention. The problems become apparent because the structure is in place to uncover them. Without the restructuring the "problems" would be considered normal practise and hence improvements would not occur. The techniques used in

tackling the problems are all compatible with the CDM's purpose in that they are all based on learning and gaining insight into the situation.

Once the majority of uncovered work related problems have been effectively dissolved, the organisation becomes ready to enter a new planning phase through developing an ability to cope with more complex situations. For this to occur the previously discussed barriers need to be overcome. In the South African situation, this too may be difficult.

If an individual is ready to move to a higher level of existence in the workplace but returns home to a squatter camp in the evenings, the barriers may be too great. Frustrations and stalling of the CDM may occur. It could be necessary for the organisation to get involved in the social aspects of its employees lives and set up child care centres, housing schemes etc. The four phases of the CDM do appear to be compatible in terms of one flowing from the other and encouraging consistent development. The facilitator is important as regards the interrelation between management, worker and ensuring each phase of the model has continuity. The concerns remain that the barriers to development will be too great. This is discussed further under methodology.

5.2 Methodology - orderly arrangement of ideas

The continuity of the various phases of the CDM has been discussed. The CDM however, is designed to be a growing loop and hence self sustaining. It is important to verify that this is the case.

Senge defines the reinforcing process as a "snowball effect" (54). For example, the rich get richer and the poor get poorer. A typical reinforcing loop is shown in Fig. 5.1

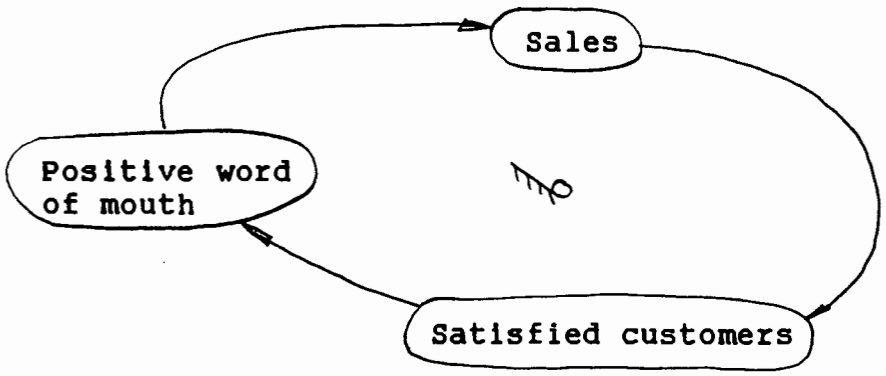


Fig. 5.1 A Reinforcing Feedback Loop (54)

The CDM is designed so that through learning to dissolve problems, the individuals, and hence the organisation, move to a higher level of existence. This makes it aware of new problems and the cycle repeats as shown in Fig. 5.2

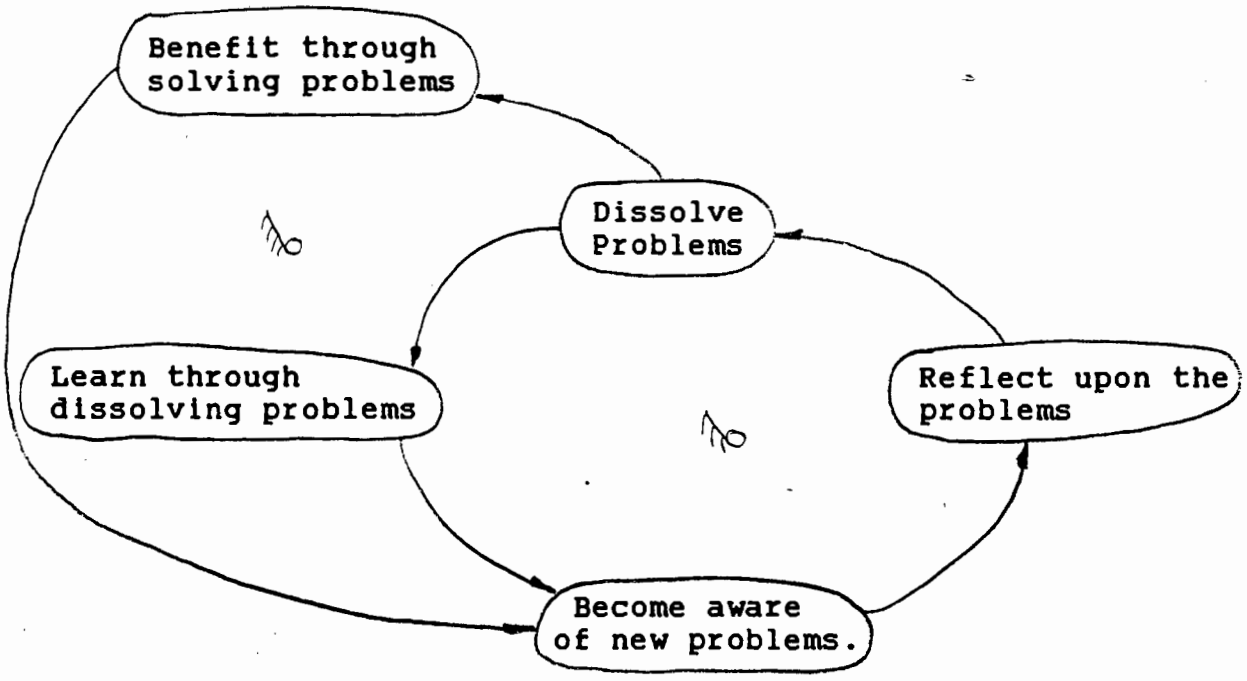


Fig. 5.2 The CDM Reinforcing Loop

If the CDM is to be self sustaining, it is important to consider what could cause this reinforcing action to weaken, stall or even reverse.

Gharajedaghi defines development as a "purposeful transformation, learning and creative process by which a given system increases its desire to serve its members and its environment by constant pursuit of beauty, good, truth and liberty". (49)

The overall purpose of the CDM is to achieve organisational development. That is the outcome of the reinforcing loop.

Gharajedaghi also discusses what obstructions to development can occur. It is worth reviewing these obstructions and considering them in the context of organisational development using the coping development model. A malfunction will be considered as a scarcity, maldistribution or insecurity of the first order social functions of economic, scientific, political, ethical/moral and aesthetic. In addition, the second order functions of alienation, polarization and corruptness are included.

The relationship between the functions is well described by Garaghedaghi Fig. 5.3

	PRIMARY OBSTRUCTIONS			SECONDARY OBSTRUCTIONS	
Dimensions of Social Systems	Expected Yield	State of scarcity	State of mal-distribution	State of insecurity	
Economic (Plenty)	Goods & Services	Poverty inefficiency	Disparity Exploitation	Fear of deprivation instability	
Scientific (Truth)	Information Knowledge Understanding	Ignorance Incompetence Rolelessness	Elitism Illiteracy Lack of communication	Obsolesence	
Political (Liberty)	Participation Influence	Impotency Powerlessness	Centralisation Autocracy	Illigitimacy	Alienation Polarisation Corruption
Ethical/moral (good)	Peace	Normlessness	Conflict discrimination	Fanaticism	
Aesthetic (Beauty)	Sense of belonging Excitement	Meaningless Helplessness Boredom	Lack of shared image of desired future Selfishness Selflessness	Fear of loss of identity Fear of loneliness & isolation	

Fig. 5.3 The Relationship between obstructions and Social Functions

(Gharajedaghi - "Towards a Systems Theory of Organisations" P. 64)

The primary obstructions will be discussed by citing a typical example of the current state of an organisation, the changed state due to coping development and a possible obstruction to development which would result in development being arrested and possibly reversed.

5.2.1 Economic

Current State: Scrap rates are excessive with rework and poor customer service due to part deliveries, returns and late deliveries. Quality of labour is poor, many people are employed, wages are low and profits are therefore not what they should be.

Changed State: Scrap rates are in control, rework minimal, customer service good. Quality of labour acceptable, less people, wages remain as before and profits are higher.

Obstruction: As the organisation generates more profit due to becoming a world class manufacturer, wages and benefits must be passed onto all concerned. Employees, as they develop will be capable of contributing more but they will expect a higher return for themselves.

5.2.2 Scientific

Current State: Poorly educated work force with a high level of illiteracy. The knowledge base resides in an elitist, expert few.

Changed State: Workforce formally and experientially educated to a level requisite with the coping demands placed upon it. A hierachical knowledge base which is capable of solving complex problems but is not allowed to do so.

Obstruction

As the individuals become higher level people, the organisation fails to recognise this and therefore does not allocate more responsibility to these individuals. They therefore leave the organisation and find employment elsewhere. The organisation changes its purpose unwittingly into a training system. People must be given responsibilities commensurate with their abilities.

5.2.3 Political

Current State: The organisation is autocratically managed with little input from lower levels.

Changed State: Interactive planning is used to direct the organisation in a purposeful manner which is consistent with all the stakeholder's needs. The unions are not involved in the change process, including the Unions.

Obstruction: Management is not serious about change and hence pays lip service to low level employees resulting in conflict and

a strenghtening of unions and eventual breakdown of the participative nature of the coping development model. All employees must be involved in the change process.

5.2.4 Ethical/Moral

Current State: Management in the hands of one race group due to the discriminatory policies of the past.

Changed State: People of all race groups are equally competent, but racism remains.

Obstruction: People must be promoted irrespective of culture, race, sex or ethnic group and based only on competence. Management maintains an elitist, racist stance therefore the leaders that are currently being developed will leave and the organisation becomes a training centre leading to eventual collapse.

5.2.5 Aesthetic

Current State: Lack of a shared image of the future due to racial segregation and communication on a very superficial level.

Changed State: Integration at the work place thereby generating a common understanding of the issues facing the organisation. Social integration does not occur.

Obstruction: Due to a lack of ability to see the other person's point of view, there is a failure to generate empathy amongst the stakeholders. This will result in the rate of change being too slow for the higher level members who will probably leave.

Social integration must be encouraged to help people realise that their view of the world is very narrow and reflects only their view of reality. It is not the only or "correct" view of reality.

Secondary obstructions are not generally as crucial as primary obstructions. In the South African context it is however most important to consider them.

5.2.6 Alienation

A social system should be a voluntary association of its members. A member must be able to stay or leave at will. If this is not possible, the member becomes alienated from the system of which is is part. Contractural or legal obligations which impose constraints on the members are not condusive to development.

5.2.7 Polarisation

If the members of an organisation are polarised based upon race, religion etc it makes an organisational shared vision almost impossible to achieve. One group wants to destroy the old system before starting a new order. Exercises in multiple perspectives

can be useful to allow all sides to see the other's point of view. This is covered by Interactive Planning and Critical System Heuristics.

5.2.8 Corruption

Developing nations do not have the time to evolve through the various levels of existence. The economic needs of a growing population demand a mechanistic production orientated society. This society has a tendency towards a closed bureaucratic system.

In addition, bureaucracies inevitably lead to corruption, inefficiency and resistance to change. Corruption eventually becomes a way of life with an attendent collapse of reward for effort and hence inequalities.

In an organisational context, management has got to lead by example and ensure that corruption and dishonesty are not present in the workplace. It is not easy to counter widespread corruption within a country, but a company culture of honesty and integrity can be fostered.

The obstructions that have been discussed need careful consideration and should formally form part of the planning process. This will ensure that the reinforcing process will continue through benefits being passed to all the players.

The Coping Development Model assumes that an individual can develop through solving work related problems. The concern remains that the poor socio-political-economic situation in South Africa may be strong enough to prevent an individual's development, even if the workplace encourages it.

5.3 Ideology - Ideas at the basis of a theory

As discussed earlier, the purpose of the Coping Development Model is to develop an organisation from the mindless, mechanistic, low level of existence through to a multiminded, social system with a high level of existence. It must be questioned whether this development is necessary or desirable.

In the mechanistic approach problems are considered as simple cause and effect situations within a closed system (55). A bureaucratic, scientific management style prevails (McGregor's "X" theory). This style suits a mechanistic organisation where people are treated like robots and respond accordingly. A mechanistic style is indeed useful when producing relatively simple products repetitively in a stable environment (56).

Why then is a mechanistic situation not maintained?

Consider the following issues:

* Ackoff's view that mechanistic system tends towards equilibrium (26).

* South Africa is currently extremely volatile and mechanistic systems are vulnerable to volatility (56).

* The sanctioned economy no longer exists and South African companies must compete with World Class manufacturers.

* A mechanistic system leads to conflicting aims between machine and mind (56). Workers are no longer prepared to be treated as robots.

It therefore appears as though change is more than desirable, it is inevitable. During this period of probably rapid and unstable change, survival will be the key issue.

Survival is seen as the primary aim in the organistic organisation (56). It is therefore important to develop an organisation from the mechanistic through to an organistic situation.

The development however must continue as the organistic view neglects to include the views of all people in the system. In addition, it assumes that the system adapts to its environment and is not pro-active (56).

Throughout the discussion and development of the Coping Development Model, it has been assumed that Grave's theory of levels of existence is correct. It is however, possible that man does not evolve and exists as he is born. If this is the case, organisational development would be difficult, if not impossible. Grave's theory is fundemental to the model and this could be a significant flaw. The model would have to be tested in practise to ascertain this.

5.4 Utility - Usefulness

In the final analysis, the utility of the Coping Development Model can only be tested practically. It is however useful to consider some pertinent aspects of application.

A key element in the model is the facilitator. This person must help maintain direction, stability and provide the necessary enthusiasm to overcome the inevitable barriers to development. This can only be achieved if human development is a primary element of his job function. A position charter detailing a typical facilitator has been compiled and appended (Appendix 4). The position charter has been drawn up using a Management by

Objectives format. Although this format is on the hard side of the hard/soft paradigm it will be easier to apply in the earlier application of the model and should be updated with practical experience. The technical job function is primarily one of training and thereby becoming trusted and respected by management and workers.

The model's intention is to develop people. This is achieved by them learning to dissolve problems. The resolution of problems has a direct impact on the business profitability. This is clearly important when justifying the cost of implementation.

There is however a possible downside. If the model fails, it becomes "just another management trick" that failed. Management will therefore lose credibility. The model should only be embarked upon with serious commitment by senior management. Without this commitment, it is possible that it could fail.

Finally, it is worth considering a technique to measure the efficacy of the model. This should possibly take the form of a questionnaire to be completed at the planning phase. The questionnaire could be useful in helping to identify people's levels of existence and their perceptions of the workplace.

In addition, a questionnaire should be completed by the organisation's customers to gain insight into their views of the organisation.

The questionnaire should be as objective as possible so as to result in a "rating" regarding the company's status as a World Class Manufacturer.

6. Conclusions

The author has presented a Coping Development Model and argued that the application of this model will facilitate an organisation evolving into a world class manufacturing company. It is based upon considering an organisation as a purposeful system which is learning to cope with and influence its environment.

It is realised that to apply the model successfully will require significant management commitment, effort and cost. However, the design of the model is such that as more and more members are drawn into the learning experience, management effort will lessen and the Coping Development process will become a way of life. In the traditional World Class initiatives, management must continually provide the energy to drive the improvement process.

The alternative to change appears to be stagnation and, in the best case, frustration by managers at having to "fight fires" every day, and in the worst case, shrinkage and collapse of the business in the face of imports on a macro scale. South Africa would then return to being a third world, raw material supplier without a manufacturing base.

The critique has identified a number of possible weaknesses of the Coping Development Model in facilitating organisational change. These issues warrant further discussion.

6.1 Difficulties with Developing a Shared View of the Future

During the planning phase of the model, planning boards are set up at each level of the organisation. These planning boards are used to present a view of the ideal organisation from all stakeholder's points of view.

It is realised that the perspectives of workers and management can be very different. In the South African situation, with its current political turmoil, these differences may be so great as to be untenable in terms of developing an ideal picture of an organisation.

Nevertheless, both parties will gain from the experience of sharing their points of view, even if they remain in conflict.

If the model is seen to be successful over a period of time and benefits the stakeholders, it is hoped that mutual trust will develop between management and workers and the planning process will function as intended.

6.2 Social obstructions to development

The model has assumed that developing an individual's ability to cope can be achieved in the workplace. An employee typically spends only half his working hours at work. During the period spent out of the workplace, he may be influenced to return to a lower level of existence. This influence may be strong enough to

counter any development process.

The solution appears to be more involvement by organisations in the employee's social situation.

Housing schemes, day care centre, bursaries etc are all possibilities. These, however, are expensive and may preclude their involvement.

The combination of lack of social upliftment and lack of company funds may result in considerable frustration when applying the model in the early stages of its application.

If, however, the organisation is benefitting from the model by generating more profits, it is most important to share these profits. Profit schemes can be designed to provide benefits which help overcome environmental barriers to development.

6.3 Is Graves' Theory Correct?

The model assumes that Grave's theory of levels of existence is valid.

This assumption may be incorrect, but will be tested by an application of the model.

In the worst case, if this theory is incorrect, organisation development may not occur. However, a strategic planning process, a process driven structure and a problem solving technique will all have been implemented. These tools should be of benefit in their own right.

6.4 Management loses face

If the model fails, it becomes another "management trick" and the failure may widen the gap between management and workers.

The author therefore suggests that the model is implemented without fanfare and rather becomes a way of doing business. Putting a name to an improvement process is, in itself, mechanistic!

6.5 Measurement of Efficiency

It would be useful to measure the state of an organisation's ability to provide world class benefits to its customers and employees. These benefits will need to be clarified before such a questionnaire can be compiled. The organisation's state may then be compared on an annual basis and the efficacy of the model noted.

It is suggested that the questionnaire become a central part of the planning process. A simple questionnaire consisting of perceived customer and employee needs can be developed over a period of time into a more substantial document.

It is hoped that these difficulties associated with the Coping Development Model can be overcome by being aware of them at the outset. It certainly appears that the benefits to be gained from an application of the model outweigh the disadvantages.

Finally, this dissertation should not be perceived as denigrating any other approach to World Class Manufacturing improvement strategies. On the contrary, it is hoped that the work will help provide more insight into the changes required in South African manufacturing.

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APPENDIX 1

PERSONNEL DEVELOPMENT OFFICE/POSITION CHARTER

POSITION CHARTER - 1991

POSITION TITLE: DIVISIONAL PERSONNEL DEVELOPMENT OFFICER

DIVISION:

PRESENT ENCUMBANT:

PREPARED BY: A F CHRISTOPHER

DATE:

APPROVED BY:

DATE:

CONTENTS:

1. Organisation Relationships

Reports directly to: Operations Director

Responsible directly for:

1. Wage Clerk

2. Authority and Limits of Authority

1. Strategic development plans and annual objectives: Approval of Operations Director

2. Expenses: Full authority for:

   a) Budgeted training programmes

   b) Expense purchase up to R150

3. Personal Expense Claims: Approval of Operations Director

5. Staff Appointments, promotions and terminations (includes casuals)
   Authority for recommendations. Final approval required by Operations Director.

6. Leave : Full authority for granting leave to departmental personnel. Authority of Operations Director required for personal leave.

7. Agreements/leases/ agents/consultants: Authority for recommendtions. Final approval by Operations Director and Managing Director.

3. Key Objectives

3.1 Purpose:

To professionally manage the Division's training and development programme, which, in conjunction with line management is responsible for ensuring that the Division's manpower has the necessary skills and knowledge to achieve the annual objectives.

3.2 Service Commitments:

To:

Develop the current employees to meet the existing and future skills and knowledge requirement of the business. This is to be carried out in collaboration with management.

Provide assistance to management regarding the recruitment and selection of all employees.

Provide a "sounding board" for staff and management regarding personnel development issues.

3.3 Customer Commitment:

To:

Satisfy the needs of the Division line managers and employees.

3.4 People Commitment:

To afford all employees and prospective employees every opportunity to meet their own development aspirations in line with the requirements of the Company.

3.5 Values

To "add value" to the company's human resources by encouraging decision making and responsibility. To treat all employees with dignity and fairness.

4. Key Result Areas

A. Managment Work:

1.1 KRA1 Planning

Objective

To systematically develop short and long term plans to meet the Division's changing needs.

1.2 Standards Performance will be satisfactory when:

1.2.1 A card carrying, temporary labour pool exists.

1.2.2 All staff will have and operate position charters. Objectives are defined and measurable criteria are agreed to by the respective managers.

1.2.3 Developing Strategies programmes and Schedules

Employee development programmes have been evaluated and developed to suit the changing needs of the Division and the Environment.

1.2.4 Budgeting

A training budget has been prepared and agreed to.

.2.5 Policies and Procedures

An induction programme for all new employees has been developed and is adhered to.

2.1 KRA2 Organising

Objective

To logically arrange, relate and delegate the work to achieve agreed specific objectives so it can be performed effectively by people to establish a state of synergy.

Standards - performance will be satisfactory when:

2.2.1 An up to date organogram for the Division exists and all salaried staff have position charters detailing their annual objectives.

.2.2 Reporting relationships are clearly understood, accepted and applied and a healthy relationship exists between management and the development officer regarding training programmes.

KRA3: Leading

3.1 Objective

To influence, inspire and develop people to take effective action to achieve pre-determined results

3.2 Standards: Performance will be satisfactory when:

3.2.1 Decision Making:

Well considered decisions are timeously made to enable people to act.

3.2.2 Communicating

An understanding is created among people so that they can act effectively and harmoniously.

3.2.3 Motivating

People are inspired, encouraged and impelled to take the required action.

3.2.4 People

The most suitable persons are recruited and selected for any available positions.

People are continually coached and developed to their full potential and realistic and reasonable career aspirations.

KRA4: Controlling:

4.1 Objective

To assess and regulate the dvelopment programme during execution and to take appropriate corrective action where necessary and assess results achieved against standard.

4.2 Standards: Performance will be satisfactory when:

4.2.1 Developing performance standards

Measurable criteria for the effectiveness and efficiency of the development programme are recommended and agreed to. These criteria are to be used for the evaluation of the development programme.

4.2.2 Measuring, evaluating and correcting performance:

Monthly feedback meetings are held to enable management to assess the performance of the development programme.

A monthly report is submitted as detailed elsewhere.

B. Technical Work

KRA5: Training Centre

5.1 Objective

To enable trainees attending the training centre to achieve pre-determined objectives by providing a structured training and development programme.

5.2 Standards: Performance will be satisfactory when:

5.2.1 A training centre which inspires the candidates to learn exists.

5.2.2 Budgets are adhered to.

5.2.3 All trainees are treated fairly and with dignity.

KRA6: Development Programme

6.1 Objective

To, in collaboration with management, develop, implement and maintain a human resources development programme specifically for Division.

6.2 Standards: Performance will be satisfactory when:

6.2.1 Operator training needs are clearly identified by way of job, task, skills and knowledge.

6.2.2 Technical training programmes exist for all levels of operators

6.2.3 All employees are aware of an understand the basic principals of business through the implementation of a 6M (or similar) programme.

6.2.4 Training modules for the following areas of the business exist:

Marketing/sales
Quality
Production
Supervision
Information systems
Basic accounting practices

6.2.5 The development programme is fully documented.

6.2.6 The end of course performance standards are measurable and meet the training needs identified.

6.2.7 All training/development programmes comply with the statutory requirement for maximum tax relief.

6.2.8 Student failures are not due to deficiencies in the programme.

6.2.9 Students can demonstrate increased competance back on the job.

KRA7: Organisational Development

7.1 Objective: To act as a catalyst to initiate and facilitate needed changes within the Division to enable the organisation to remain viable and adapt to the changing social, economic, political and business environment in South Africa.

7.2 Standards: Performance will be satisfactory when:

7.2.1 Management understand the changes occurring in the aspirations of the people of South Africa and are able to adapt their management style to best suit these changes.

7.2.2 A Divisional "culture" and team spirit is stimulated and encouraged through the organisation of a company magazine, sporting events etc.

APPENDIX 2

CONTROL CHARTS FROM S.A.B.S. 0157 A GENERAL GUIDE TO THE PREPARATION OF QUALITY DOCUMENTATION.

MANUFACTURING CONTROL CHART (4.8)

Control Point	Test	Test No.	Frequency of In-process Checks	Frequency of Quality Assurance Monitoring	Responsibility for Test	Feedback	Corrective Action	Document Reference
a) A brief description of the activity; b) a statement of any signatures/works Nos. on routing cards or control documents, which afford traceability and identify responsibility; c) a statement of hold/release procedures necessary at key control points e.g. loom start-up checks, shade and colour fastness approval; d) reference to any appropriate work instructions. Typical examples of work instructions are: i) Colour coding in yarn manufacture; ii) Loom Card at weaving machine; iii) Dyehouse Recipe Sheet; iv) Finishing Routing Card.	The tests and checks relevant to the control points.	A cross-reference to the appropriate test method e.g. SABS test No., ISO test No. or manufacturer's own test No. There are certain instances where test No. may not exist.	A statement of the frequency of testing or checking carried out by production personnel.	A statement of the frequency with which quality assurance personnel carry out tests and checks to monitor process and product performance.	The person responsible for performing those tests or checks that are carried out to give early warning of the need for corrective action. This is the person in production carrying out in-process tests or checks, even in cases where quality assurance personnel monitor those tests.	The person to whom the results of tests and checks are reported, and who is responsible for initiating corrective action.	a) A brief description of the corrective action taken to eliminate the fundamental cause of failure; b) the procedures for any re-testing/checking to confirm that the action taken has been effective; c) the procedures for controlling any non-conforming product; d) a statement of any records kept of the corrective action taken and its effectiveness.	A cross-reference to the examples of control documents and records contained in the Appendix.

MANUFACTURING CONTROL CHART (4.8)

Control Point	Test	Test No.	Frequency of In-process Checks	Frequency of Quality Assurance Monitoring	Responsibility for Test	Feedback	Corrective Action	Document Reference
2(b) CARDS Material is processed in accordance with monthly Spinning Program, received by the Card Room foreman.	Spinning program	—	Once per week		Card Room Foreman	Spinning Manager	Problems arising from Spinning Program are discussed with Spinning Manager, who initiates corrective action.	Spinning Program
Each quality is identified by means of colour coded sliver cans. Cans are also identified with card frame number, to ensure traceability back to individual card frame. All cards fitted with Uster autoleveler units. Each card frame has a Job Card stating: Quality, colour code, doffer speed, linear density	Linear density	5		All cards twice/ week according to sample plan	Laboratory Assistant	Card Room Foreman — Spinning Manager	Non-conforming sliver is reported to Card Room Foreman with Laboratory Test Sheet. Card Room Foreman instructs mechanic to adjust machine, resample to confirm adjustment is effective. All adjustments recorded on test sheet and Machine History Log Book. All records signed. Rejected sliver is isolated and reprocessed.	Laboratory Test Result Sheet — Machine History Log Book
	Nep count	6	Web condition monitored throughout production by operator.	All cards once/ week as per sample plan				
	Waste content	7		Whole production once/week				
	Evenness	8	All cards once/ week in planned rotation.		Shift Controller	Card Room Foreman — Spinning Manager	Card Room Foreman instructs mechanic to rectify faults, runs fresh sample to confirm corrective action. Mechanic records adjustment in Machine History Log Book, all records signed.	Machine History Log Book
Cards are stripped and ground, according to the Card Room Maintenance Schedule.	Card Room Maintenance Schedule	—	As per schedule or in the event of damage		Card Room Foreman.	Card Room Foreman — Spinning Manager	Card Room Foreman instructs Maintenance Foreman to rectify any machine faults, re-checks and signs Card Maintenance Record Sheet	Card Room Maintenance Schedule Card Maintenance Record Sheet
Air conditioning checked by Laboratory.	R.H. %	Sling Hygrometer		Every shift	Laboratory Assistant	Spinning Manager	Plant Engineer adjusts conditioning plant.	Spinning Laboratory Records

MANUFACTURING CONTROL CHART (4.8)

Control Point	Test	Test No.	Frequency of In-process Checks	Frequency of Quality Assurance Monitoring	Responsibility for Test	Feedback	Corrective Action	Document Reference
2(g) RING FRAMES Yarn is processed as per Spinning Program								Spinning Program
Each count and quality is identified by colour coded roving bobbin and ring tube.	Bobbin/tube stock.	—	Every morning	—	Ring Spinning Foreman.	Spinning Manager	Ring Spinning Foreman rectifies incorrect stock levels.	
Work Instructions are on each ring frame stating tex, quality, twist factor, spindle speed, colour code and traveller change history. Linear density, twist and lea strength tests done at every count change on each frame to confirm continuity of product.	Linear density	5		5 tubes/day per frame	Laboratory Assistant	Spinning Manager & Ring Spinning Foreman	Non-conforming yarn reported to Ring Spinning Foreman with Laboratory Test Sheet. Ring Spinning Foreman instructs mechanic to rectify machine faults. Resamples to confirm corrective action effective. All adjustments recorded on Laboratory Test Sheet and in Ring Frame History Log Book. All records signed and dated. Non-conforming yarn is isolated for management disposition.	Laboratory Test Sheet
	Lea breaking strength	9		5 tubes/day per frame				
	Single thread strength	10		10 tubes/count/ week				Ring Frame History Log Book
	Yarn evenness	11						
	Twist	12		5 tubes/count/ week				
	Yarn appearance	13						
	Yarn imperfections	14		10 tubes/count/ week				
	Moisture, %	15		On request				
	Spindle speed	Strobo-scope	All frames once per week		Shift Process Controller			

MANUFACTURING CONTROL CHART (4.8)

Control Point	Test	Test No.	Frequency of In-process Checks	Frequency of Quality Assurance Monitoring	Responsibility for Test	Feedback	Corrective Action	Document Reference
Doffs from ring frame are put into boxes with doffing tickets, stating ring frame No., count/quality, shift and date, signed by Doffer. These boxes are then weighed, the weights are recorded in production book and signed by Head Doffer.	Doff	—	Every doff		Head Doffer	Ring Foreman	Head Doffer amends incorrect doff ticket and signs for the correction	Doffing Ticket
Air conditioning check by Laboratory	RH, %	Sling Hygrometer		Three per shift	Laboratory Assistant	Spinning Manager	Plant Engineer adjusts conditioning units	Spinning Laboratory Records.

MANUFACTURING CONTROL CHART (4.8)

Control Point	Test	Test No.	Frequency of In-process Checks	Frequency of Quality Assurance Monitoring	Responsibility for Test	Feedback	Corrective Action	Document Reference
3(e) DRAWING-IN/GAITING Operator draws-in in accordance with Weaving Specification and signs Beam Card. Gaiter sets up loom according to specification and signs Loom Card. Loom Tuner checks loom settings according to Loom Card and Check-List and signs Loom Card.	Draft	—	Every gait	—	Operator	Supervisor	Faults found in draft or denting are corrected, and re-checked by Supervisor. Completely wrong draft is redrawn and checked by Supervisor.	Weaving Specification Beam Card
	Denting	—						
	Reed count	—						
	Reed width	—						
	Draft	—	Every gait or knot	—	Gaiter	Loom Tuner	Gaiter checks and repairs faults in draft or denting	Weaving Specification Loom Card
	Denting	—						
	Machine settings	—	Every gait or knot	—	Loom Tuner	Supervisor	Supervisor informs Gaiter to rectify incorrect settings. Loom Tuner rechecks to confirm action effective.	Check-List (a) Loom Card
Condition of loom parts recorded on Check-List.	Loom parts and accessories	—	Every gait or knot	—	Loom Tuner	Weaving Manager	Weaving Manager assesses adjustments made on Check-list to decide appropriate action for replacement.	Check-List (b)

MANUFACTURING CONTROL CHART (4.8)

Control Point	Test	Test No.	Frequency of In-process Checks	Frequency of Quality Assurance Monitoring	Responsibility for Test	Feedback	Corrective Action	Document Reference
3(f) WEAVING **Start-up Checks** Once the Loom Card is signed by the Loom Tuner a sample piece is woven. Patrol Inspector removes first 0,5 m for immediate laboratory analysis, stops loom by placing HOLD card on loom. On approval Weaving Supervisor signs Loom Card and removes HOLD Card permitting weaving to commence. Weaving cannot continue without these two signatures.	Weave	—	—	Every gait or knot	Patrol Inspector	Supervisor	Supervisor instructs Loom Tuner to adjust settings. Patrol Inspector resamples to confirm adjustments effective. Laboratory Assistant repeats start-up tests — on approval Weaving Supervisor signs Loom Card. Significant adjustments to loom recorded on Machine History Card and reported in Log Book. All records signed.	Loom Card Machine History Card Log Book
	Denting	—						
	Colour	—						
	Selvedges	—						
	Design	—						
	Ends/cm	22			Laboratory Assistant			
	Picks/cm	22						
	Mass	23						
	Width	24						
Running Checks Weaver, Patrol Inspector, and Supervisor patrol looms and inspect fabric while weaving continues. Weaver cuts each piece and writes details on end of fabric. Weaver signs and attaches completed Piece Ticket, permitting piece to be transferred to Grey Inspection.	Picks/cm	22	—	Every loom once per shift	Patrol Inspector	Supervisor	Defects identified during patrol inspection are reported to Loom Tuner who makes adjustments. Fabric rechecked before weaving continues. Seriously non-conforming fabric sent immediately to Grey Inspection for grading and decision from Weaving Manager whether to continue weaving. Investigation initiated. Significant adjustments are recorded and records signed.	Loom Card Piece Ticket Machine History Card Log Book
	Weaving Defects	—	Every loom visually monitored throughout weaving	Patrol Inspection	Weaver Patrol Inspector			
	Denting	—						
	Selvedges	—						
	Design	—						

APPENDIX 3

ROOT DEFINITIONS AND MODELS FOR S S M.

Formulation of Root Definitions

Consider the following elements: CATWOE

C customer	Who would be victims/benficiaries of the purposeful activity?
A actors	Who would do the activities?
T transformation process	What is the purposeful activity expressed as input — [T] — output — ?
WWeltanschauung	What view of the world makes this definition meaningful?
O owner	Who could stop this activity?
E environmental constraints	What constraints in its environment does this system take as given?

Example:

A professionally-manned system in a manufacturing company which, in the light of market forecasts and raw material availability, makes detailed production plans for a defined period

CATWOE analysis –

C	people in the production function
A	professional planners
T	need for production plan — need met; or: information — plan
W	rational planning of production is desirable and possible; there is the degree of stability needed to make rational planning feasible
O	the company
E	staff and line roles; information availability

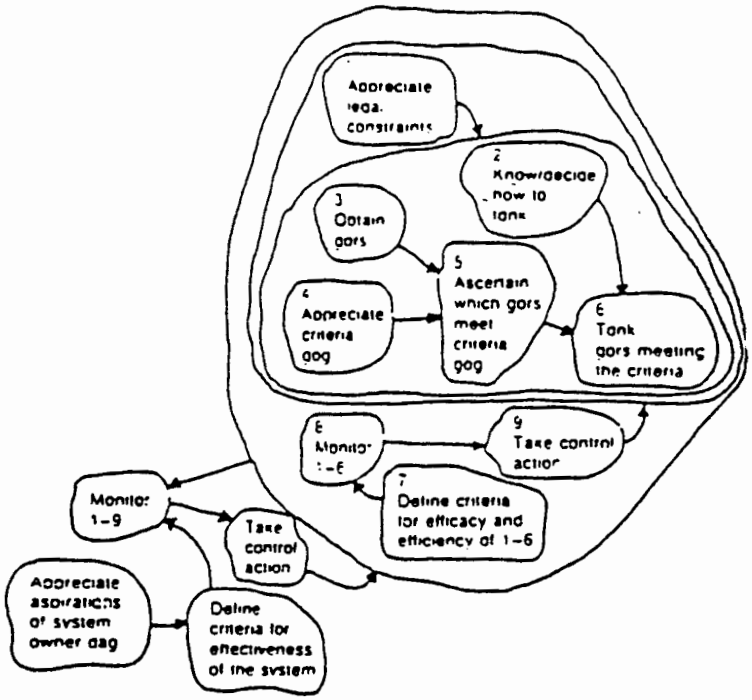
Model Building:

A defensible logical structure for a model may be derived from a root definition even though knowledge of any real-world version of the purposeful activity is lacking!

Root Definition

> A dag-owned gor tonking system which, within legal constraints, tonks those gors which meet criteria gog.

C gors
A not stated (skilled tonkers implied)
T gors — tonked gors
W gor tonking is a good thing to do
O dag
E legal constraints



APPENDIX 4

THE TWELVE CRITICAL HEURISTIC QUESTIONS FOR THE CHS METHODOLOGY

Table 9.1 The 12 critically heuristic boundary questions in the "is" mode

(1)	Who *is* the actual *client* of S's design, i.e. who belongs to the group of those whose purposes (interests and values) are served, in distinction to those who do not benefit but may have to bear the costs or other disadvantages?
(2)	What is the actual *purpose* of S's design, as being measured not in terms of declared intentions of the involved but in terms of the actual consequences?
(3)	What, judged by the design's consequences, is its built in *measure of success*?
(4)	Who is actually the *decison taker*, i.e. who can actually change the measure of success?
(5)	What *conditions* of successful planning and implementation of S are really controlled by the decision taker?
(6)	What conditions are *not* controlled by the decision taker, i.e. what represents *"environment"* to him?
(7)	Who is actually involved as planner?
(8)	Who is involved as *"expert"*, of what kind is his expertise, what role does he actually play?
(9)	Where do the involved see the *guarantee* that their planning will be successful? (E.g. In the theoretical competence of experts? In consensus among experts? In the validity of empirical data? In the relevance of mathematical models or computer simulations? In political support on the part of interest-groups? In the experience and intuition of the involved?, etc.) Can these assumed guarantors secure the design's success, or are they false guarantors?
(10)	Who among the involved *witnesses* represents the concerns of the affected? Who is or may be affected without being involved?
(11)	Are the affected given an oppportunity to *emancipate* themselves from the experts and to take their fate into their own hands, or do the experts determine what is right for them, what quality of life means to them, etc? That is to say, are the affected used merely as means for the purposes of others, or are they also treated as "ends in themselves" (Kant), as belonging to the client?
(12)	What *world view* is actually underlying the design of S? Is it the world view of (some of) the involved or of (some of) the affected?

Table 9.2 The 12 critically heuristic boundary questions in the "ought" mode

(1)	Who ought to be the *client* (beneficiary) of the system S to be designed or improved?
(2)	What ought to be the *purpose* of S, i.e. what goal states ought S be able to achieve so as to serve the client?
(3)	What ought to be S's *measure of success* (or improvement)?
(4)	Who ought to be the *decision taker*, i.e. have the power to change S's measure of improvement?
(5)	What *components* (resources and constraints) of S ought to be controlled by the decision taker?
(6)	What resources and conditions ought to be part of S's *environment*, i.e. not be controlled by S's decision taker?
(7)	Who ought to be involved as *designer* of S?
(8)	What kind of *expertise* ought to flow into the design of S, i.e. who ought to be considered an expert and what should be his role?
(9)	Who ought to be the *guarantor* of S, i.e. where ought the designer seek the guarantee that his design will be implemented and will prove successful, judged by S's measure of success (or improvement)?
(10)	Who ought to belong to the *witnesses* representing the concerns of the citizens that will or might be affected by the design of S? That is to say, who among the affected ought to get involved?
(11)	to what degree and in what way ought the affected be given the chance of *emancipation* from the premises and promises of the involved?
(12)	Upon what *world views* of either the involved or the affected ought S's design be based?